JOURNAL OF GAS LIGHTING & WATER SUPPLY.

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EDITORIAL NOTES.

Christmas-tide.

BEFORE we shall have an opportunity of again addressing our readers, Christmas Day will have come and gone. We do not feel disposed, and it would not be meet, to on this occasion extend to all without discrimination the time-honoured greeting of "A Merry Christmas." With the great Christian Festival, we associate peace on earth and goodwill toward men. But there is little peace on earth to-day; and goodwill toward those who instituted war against peace is more than one of this and the allied countries can be expected to entertain. "A Merry Christmas!" when homes have been darkened by the shadow of Death, and when absent fathers, husbands, sons, brothers, and other relatives and friends are defending, at the continuous risk of their lives, our country's honour, and the liberty and civilization of the world, against a ruthless and merciless foe! In the circumstances, there cannot be the usual merriment in the home. There are too many absent ones; and great issues affecting one and all as individual units of a nation are in the balance, to be determined the one way or the other only by the blackest and most violent of strife. But we need not all be sad. The cause is a glorious one in which we and our kith and kin are fighting; and sadness need not cloud the lives of the youngsters who do not appreciate all that at the time is at stake, and all the horrors attending its deciding. But if we, with suffering and anguish at our very doors, if fortunately not within them, do not feel disposed to use the familiar greeting, this one and all being united in common desire and sympathy can hope—that there may be fully re-established, and that speedily, though by the only means that the enemy permitted, a durable peace in the world, and good-will among its peoples.

Gas-Works under Bombardment.

THE civilized world has stood aghast at the fresh evidence, furnished by the Naval raid on our North-East coast towns last Wednesday, of the brutality of the Germans in war. Over the dastardly piece of work the citizens of Berlin have been rejoicing, and acclaiming the courage of their Navy, which has shown a profound wisdom by keeping itself concealed as much as possible. The ships of the Navy which took part in the inglorious events of Wednesday crept out from their hiding-places, sneaked through the prevailing sea mist, showered shells on unfortified towns, and killed and wounded a large number of people, among whom women and children predominated; and after this cowardly work, before any of our cruisers could intercept them (other than the challenge of a few torpedo boat destroyers), the officers of these ships caused them to scuttle back to cover again. Germany thinks that there is something to be proud about in the achievement. It is hoped there is not a German resident in this country—naturalized or otherwise—who, knowing the facts, has viewed the craven work with any satisfaction.

There can be little question that the gas-works of Scarborough, Hartlepool, and Whitby were among the premeditated targets of the German war-vessels. Inconvenience, as well as cold-blooded destruction of life and property, was one of the objects of the raid, as well as probably an expectation on the part of those who organized the raid that shell-punctured gasholders would by exploding cause a large amount of local mischief. They probably know better by this time. In the case of Hartlepool, all three gasholders were struck, and put out of action—one of them being seriously damaged. But at Scarborough, only one holder was slightly punctured, and a very small quantity of gas lost; while at Whitby a holder was merely dented, but not punctured, by a piece of shell. The Scarborough and Whitby works were fortunate; for round about them many shells fell, and caused a fair amount of damage to roadways and houses. At Scarborough, for example, road-openings, some 8 feet in diameter, made by bursting shells, were seen in the neighbourhood of the works. In town bombardments on the Continent, though gas-works have not escaped the attentions of the Germans, the damage has not been very grave. Into the Berchen works at Antwerp of the Imperial Continental Gas Association, some forty shells were dropped, and only damage repairable at a cost of about £2500 was done. Into the works at Hartlepool some twenty shells fell. The temporary putting out of action of two holders, and the crippling of one to such an extent that it will take two or three months to put right, was the worst that resulted. Otherwise buildings suffered little; and the gas-manufacturing plant remained intact. But gas-producing plant is of little use for urban purposes without storage; and so storage, which is one of the strongest points in gas supply in competition with electricity, is in war the most vulnerable point at which to deprive a community of its gas supply. Hartlepool had, therefore, on Wednesday and Thursday, to satisfy itself largely with candle and oil light, while the prompt measures taken by Mr. Arnold W. Branson (the successor in office to, and the former pupil of, Mr. Thomas Bower) to repair the most negotiable damage to the holders, enabled him to recommence the supply on Friday—having, we understand, by that time two holders at work, enjoying a united capacity of some 2¼ million cubic feet.

The responsible engineer in such an emergency has not only his works to look after, but he has to prevent damage through broken distribution pipes in roadways and shattered gas-fittings in houses. Mr. Branson, at Hartlepool, Mr. A. Phillip Allan at Scarborough, and Mr. W. M. Galleway at Whitby, had a rapid survey made of their districts and the injured houses. The only street main that appears to have suffered was a 3-inch one at Whitby; but in all three places, there were house pipes for the Companies' fitters to cap-back, or to otherwise deal with. In the town bombardments in the north of France, there seems, generally speaking, to have been more damage done in the districts than on the works—that is to say, so far as information has been forthcoming, this has been so. The three gas engineers named, and especially Mr. Branson, we are sure, have the sympathy of all their colleagues in the gas profession, and congratulation that things were not worse for them. Though seven or eight gas men were injured at Hartlepool, no lives were immediately lost on the works; one man has since died.

One thing that we anticipate will result from this raid is that, in gas-works along the eastern coast in which there are oil-tanks—whether or not the flash-point of their contents is below 150° Fahr.—the engineers will take the necessary precautionary steps to prevent any ignited oil from them, in the event of another senseless raid of this kind, flowing about the works, and so setting up a second danger to the manufacturing plant.

Lights and Coloured Fabric Deterioration.

THERE are some people who are in the habit—and it is a bad habit—of attributing to the combustion of gas both for lighting and heating all manner of ill-effects to the human being and to goods of various descriptions. The reflection of this proceeding on the intellectual capacity and honesty of those who pursue the vicious practice does not appear to concern some of them much, as their sole object is by any means, foul or otherwise, to obtain additional credit for electricity at the expense of gas. We do not say that the writer of "Textile and Engineering Notes" in the "Yorkshire Observer" is one of these people; but we do assert that he stands convicted of making assertions which his own chemical knowledge—if he is possessed of any—will not enable him to substantiate. In the course of last summer, he published a statement regarding the effect of not only gas lighting, but flame arc lamps, on the colours of fabrics. To both of these forms of lighting the statement was a damaging one—in truth, more so to the flame arc lamp than to incandescent gas lighting. What happened

was that, with a "courage" and a "chivalry" that would have done justice to certain officers of the German Navy who have been guilty of bombarding unfortified coast towns and killing defenceless women and children, "Meteor" of the "Electrical Times" jubilantly adopted and quoted what the writer of "Textile and Engineering Notes" had to say in our Yorkshire contemporary about incandescent gas lighting, and ignored altogether what was said about electric flame arc lamps. The matter was noticed in our "Electricity Supply Memoranda" on Sept. 22 last.

This attempt to traduce incandescent gas lighting in order to advantage incandescent electric lighting has failed. In all these attacks upon gas lighting, there are two or three things that are forgotten; and they are that gas lighting is not a thing of yesterday, and that experience is of an extensive order, and is able to supply the effective answer to all feeble assaults from the electrical side. It is curious that 1914 should have arrived before it was discovered by electrically or otherwise interested parties that gas lighting had the malign effect alleged—a deteriorating influence upon the colour of fabrics. Our revered grandmothers and mothers, our dear sisters and aunts, and all the feminine line of relatives and friends wore, and those who have not departed still wear, their evening costumes under the rays of the incandescent gas-light. But we do not remember any one of them ever complaining that the tones were in consequence in any way affected, though often elaborate protection was and is sought for dresses which, exposed to the sun's rays, soon show the fugitive character of their colours. On the simplest of pertinent evidence, there ought to have been hesitation in making (without positive proof) the accusation as to gas lighting being a serious cause of material fading, instead of the writer proceeding in the happy belief that postulation would be sufficient to obtain credence for the point. Many large drapery establishments are also lighted by inverted incandescent burners, solely because the owners know that a better judgment of colours can be obtained by them than with incandescent electric lamps. The British Commercial Gas Association soon took up the matter. The Association have at hand chemical and other experts in a position to make research; and, to put these particular allegations to the test, experiments have been made as to the influence upon the colours of fabrics of temperature, products of combustion, and illumination from incandescent gas-burners in comparison with the exposure of the same fabrics to daylight. So far as we can remember or trace, a similar set of experiments has never before been made. Therefore, we take it, there has been no call for investigation until the modern discovery of this fresh piece of alleged mischief on the part of incandescent gas lighting.

The report upon the investigation has been published in the "Yorkshire Observer" under a covering letter from the Secretary of the Association (Mr. W. M. Mason). The report is reprinted in other columns to-day; and one thing that even our most critical of critics will concede is that it is distinguished by a perfect frankness as to the effects of incandescent gas lighting. It will also be observed that the Association did not trouble themselves to investigate the truth of the allegations as to disastrous effects upon the colours of fabrics of fumes from flame arc lamps. A further point that will be remarked is that every one of the experiments was carried out under peculiarly stringent conditions, which brought the fabrics into direct and abnormal exposure to the conditions which might be supposed (if any one of them had any activity at all) to cause colour deterioration. What, however, was the general result of the experiments? That in the majority of cases, after the acute treatment, there were no appreciable changes; with two or three of the colours there were slight changes, but, be it noted, not in every case a fading. For example, with dark red, there was a slight brightening of the colour. In no case did the same silks and cloths exposed to daylight emerge from the experiment without a destructive result upon the colours. The deduction from the experiments (which are open to verification by anyone) is that "no deteriorating effect from the use "of gas lighting is of any practical importance compared "with the effect of daylight, especially when the abnormally "severe conditions of the experiments are taken into ac-"count." This is a very satisfactory finding. Is anyone prepared to contest it?

The point is also made by the investigator that the character and purity of the materials used in the dyeing and finishing of the silks and stuffs are likely fundamental causes of the instability of different colours—varying according to the influences brought to bear upon them. This reminds of the allegations that were formerly levelled against gas in regard to leather book-bindings. But experts, and not the retailers of hearsay and ignorant assumption, found that the dressing of the leather itself had much more than anything else to do with its early destruction. Before the Departmental Committee on Gas Testing, over which Lord Rayleigh presided, Dr. J. G. Parker, who is an authority on leather, said it was not sufficient to find free sulphuric acid in leather to put gas down as the cause of decay, as sulphuric acid was frequently used in scouring and bleaching the leather and in the dyeing process. Sulphuric acid was employed to bring out the colours of the aniline dyes; and the dye-stuffs themselves were developed by formic acid, or acetic acid, or lactic acid. This shows that it is not wise, when making assertions as to the influence of one thing upon another, to neglect a thorough survey for the purpose of ascertaining whether there are not more active and potent influences—either external or internal. The lesson is well worth bearing in mind by critics.

Style and Method in Developing Coke Sales.

LATELY our columns have been very much alive with information as to the development of the use of coke for steam-raising. There is another article this week, in which "A Gas Engineer," who was responsible for a series of instructive contributions on the subject, submits for consideration a code of instructions for the users of coke for steam-raising. If anyone has aught to say in criticism of these instructions, the author of them will be very pleased to discuss the matter with his critics through our columns. In one of his early articles, the same contributor instanced the enormous field that the steam-boiler offers for the absorption of gas-works coke; and now incidentally Mr. E. C. Boughton, of the Bradford Corporation Gas Department, in a paper (which was supplemented by one by Mr. Charles Roper on the preparation at Bradford of coke for household purposes) read last Saturday before the Yorkshire Junior Association, indicates the enormous area that the domestic hearth also offers for the use of coke. These two "strings" that the gas industry has "to its bow" in relation to coke disposal are remarkably strong ones. The paper read by Mr. Boughton recounts the special and praiseworthy constructive efforts that have been made by the Bradford Corporation Gas Department in connection with the coke business. The result has been remarkably good; and yet in Bradford itself only some 15 per cent. of the householders have been tapped as customers, leaving 85 per cent. as the potential field for cultivation work. Between steam boilers and domestic purposes, therefore, there are some gas undertakings that ought to be able to build up such a coke connection that their whole output should find constant local absorption.

One thing that has been insisted upon in connection with the development of the employment of coke for steam-raising purposes has been that, unless care is taken in the preparation of the material, and also in demonstrating to the user, and instructing him in, the best methods for its employment, the steam-boiler as an outlet for coke consumption might as well be left alone, for its non-permanent patronage of coke is certain, unless its owner is a persevering individual, and capable of ascertaining for himself the best procedure in application. But steam-boiler owners have usually something else to do, and the boiler attendants are not normally inclined without resistance to make any departures from their old ways. Mr. Boughton's paper likewise contains its lesson under this head in connection with the domestic coke business. He also says, in other words, that the domestic business is to be obtained if the developing work is done well and persistently. There is all the difference between good and bad style in cultivating business. The coke business in many places has long enough been treated as a sort of side-issue of the gas business, and a hole-in-the-corner place has been granted to it for the vending. But the coke output is now such that it requires to be placed on the footing of a commodity running co-equally with gas, and to be allowed a corresponding frontage to the latter. The system adopted at Bradford has been to send through the post facsimile typewritten letters, with the printed signature of the chief executive officer of the Gas Department (Mr. Charles Wood) at the bottom, and addressed from the head office of the Gas Department; good style order cards and standing-order cards have also been

sent out; and the follow-up circular-letter has been applied, so as to get repeatedly into touch with householders. Newspaper advertising, too, has been adopted. In all things that have been undertaken in this connection since the beginning of the 1913-14 winter season, continuity of effort (whether coke stocks are large or small) and good style have been practised. The reward in sales and standing orders has been good, and has justified the new and up-to-date system. The papers by both Mr. Boughton and Mr. Roper will, we are certain, be read with interest to ascertain the lines of work that have proved so successful in Bradford; and the results quoted in the first one will encourage many other gas managements carrying uncomfortable stocks of coke to go and do likewise.

Recruiting among the Non-Subscribers.

Many are the times that effort has been made by the British Commercial Gas Association to obtain the cohesion of those undertakings that are still of the mass of non-subscribers. Numerous though the non-subscribing concerns are, they represent only one-fifth part of the urban gas consumption in the United Kingdom, which shows that, by joining the existing co-partners in publicity and educational work, they will be in excellent company. The Association are starting a fresh campaign among those who still stand aloof; and they want to make their recruiting endeavours as effective as possible. To this end, a list of undertakings has been prepared arranged as a county index, and against the subscribing undertakings an asterisk has been placed. There are, however, stretches of unasterisked names. It is passing strange that in England some counties show a very good proportion of subscribers, while others are remarkably poor. Certain of the Scottish counties cannot boast of a single asterisk; while others are sparsely so distinguished. The Irish counties are almost destitute of any indication of co-operative effort; and Wales does not come out with such good showing as we should like to see it. Practically every non-subscribing undertaking has received a copy of the last annual report, together with a copy of the "Bulletin" which contains special reference to the activities of the Association. Something more is required. Direct and indirect appeals by post have failed to move the purveyors of the last one-fifth part of the gas consumption of the United Kingdom. Perhaps personal influence might have better effect; and here can come in those representing subscribing undertakings. It is difficult to know how to most diplomatically handle a matter of this kind, Let us suggest that one way would be by the administrators of undertakings that are subscribers in a county co-operating in calling a conference of the administrators of non-subscribing concerns, and so making a decided endeavour to enlist their sympathy and material support. The work of the Association is not carried on in the interests of any particular section of the industry. It is work for all; and some of the best brains the industry possesses freely lend aid to its furtherance. We do not want to see another copy of this list of gas undertakings until the asterisks are numerically stronger.

The Annual Rating Statistics.

The close of another year is upon us; and it has again brought with it the annual array of statistics on which such pains are bestowed by the compiler—Mr. James Carter, the Borough Treasurer of Preston. The present is the thirtieth issue of the series; and it contains information on just the same lines as did its predecessors—that is to say, with regard to the rates levied, the charges for domestic supplies of gas, water, and electricity, and the profits and losses on municipal trading undertakings which have gone to reduce or swell the rates. As time has gone on, the number of towns included in the statistics has increased, though the total—at 134—is the same on this occasion as it was twelve months ago. The range covered is a wide one, Mr. Carter having brought together all sorts and conditions of towns—from big residential and business boroughs in the Metropolis and important manufacturing centres, to quite small provincial towns. Glancing to see how the 1914-15 figures compare with the 1913-14 ones, it is seen that this time in 24 of the towns mentioned the amount in the pound levied for rates is 9s. or over, as against 20 a year ago. Norwich heads the list with 11s. 3d. in the pound, or 3d. more than twelve months ago; while a drop of 8d. to 10s. 7d. brings West Ham from first place to third—East Ham on this occasion coming in between with 11s. 1d. The rates were also 10s. or over in Batley, Colchester, Halifax, Lowestoft, Merthyr Tydfil, Stoke, and Wolverhampton. Looking through the list, it seems there has been a noticeable tendency towards increased rates, though there are still three towns included where the amount in the pound is 5s. or less—Blackpool, Bournemouth, and Oxford. There is a table giving the prices of gas for domestic lighting; and in this there are included 28 places where the charge is 2s. or under per 1000 cubic feet, compared with 31 a year ago. In this table, Widnes and Sheffield continue to hold their accustomed places, as first and second respectively, in the matter of cheapness. Another point which the statistics reveal is that in 17 of the towns named the rates are relieved from remunerative undertakings to the extent of 1s. or more in the pound—this comparing with 19 on the previous occasion. On the other hand, in 63 cases there were deficiencies to be met for such undertakings out of the rates, though in only three instances did the amount by which the rates were consequently increased reach 1s. in the pound. There were no deficiencies on gas; but there were in respect of eight electrical undertakings belonging to the 134 towns.

A Question of Lighting.

An inquiry was held last May which was of such an extraordinary character that one would have had a difficulty in supposing anything of the same kind would be likely to crop up again in the near future. The inquiry was one held on behalf of the Local Government Board with reference to a desire by a Board of Guardians—or a portion of the Board—to borrow a sum of money to cover the cost of installing electric light and power in the institutions under their care. The hearing occupied several days; the larger portion of the time being taken up in demonstrating how little, not how much, definite information regarding the proposed installation there was to place before the Inspector. A full report of what transpired was published at the time in the pages of the "JOURNAL;" and this revealed the fact that those responsible for presenting the scheme were totally unprepared to definitely answer the searching questions which were put to them. Though it did seem unlikely that a case at all similar would soon arise again, the unexpected has happened; but on this occasion the scene of action is transferred from London to Altrincham. Certain streets of this town, which have hitherto been lighted by incandescent gas, were—so it was designed—to have shed upon them the kindly rays of electricity; and an application was in due course made to the Local Government Board for sanction to the borrowing of the necessary capital. The usual inquiry followed—how fortunate it is that these public inquiries are held!—and the Inspector evinced a perfectly proper curiosity to get at all the facts of the case. This was accomplished in due time, and it was found that there were indeed very few facts; the whole scheme seemed to have been built up on a foundation of surmise. The question of cost is an important one to the ratepayers; but there were no estimates at all available, and the Inspector was reduced to the necessity of working out his calculations of cost for himself. This he did without great trouble, and with a result which knocked the bottom out of the proposal to change the system of lighting. The application broke down, and the Council have since shelved the subject for the time being. This was all on the point of cost. The question of efficiency is another matter; and it is here that the Altrincham Gas Company come in. The evidence of a Director at the inquiry showed that there is room for improvement in the public gas lighting; and it is to be hoped that the Company will make the most of their opportunity to induce the Council to put this important service on a proper basis.

Marble to the Rescue.

Knowledge grows as to the harmful effects of high intrinsic brilliancy lamps—such as those of the metallic filament order and arc lamps by whatever description they are known. From scientific sources, too, information has come that the infra-red rays—those which are not found in diffused daylight—are as harmful as the ultra-violet rays. Something has to be done to protect the eyes from these malevolent influences; and naturally opaline or frosted glass has been the ready-at-hand system of affording protection. But such glass has had the disadvantage that, while it partially corrects the evil, it has the disadvantages

of materially depreciating efficiency, and giving passage to the dangerous infra-red rays and partly to the ultra-violet rays. Prismatic glassware is in some respects better; the light absorption of which, one writer—W. E. Barrows—tells us, is from 5 to 12 per cent. But now comes intelligence that there is nothing like specially polished and impregnated marble for providing a barrier to all the evils which are inherent to electric lamps. Herr Volge cries "Eureka" over the method devised by Herr Engel for specially treating thin sheets of marble for the purpose of shielding lights, as is seen by the article published on the subject in our columns this week. Specially treated marble—like some pills that are an asserted cure for all the evils to which flesh is heir—is a sure preventive of all eye disaster by over-brilliant lights, and lights containing an undue proportion of the infra-red and the ultra-violet rays, and this with less depreciation of lighting and diffusing power than by any other means.

The Remarkable Effects.

While electric filaments are visible with ground glass, they are not so with marble and opaline screens; and the marble is said to be superior to opaline glass because screens made of it are regularly illuminated as far as the edges, and give the impression of pure white. The prepared marble also absorbs yellow green; and this explains the yellow tint. Its diffusion efficiency is particularly good; in spite of its great transparency, it is not inferior to opaline glass from the point of view of dispersion. In fact, after careful and repeated experiments, Herr Volge is able to say that marble is not inferior to any other substance, either from the point of view of economy or of the distribution of light. Marble, indeed, is to be preferred on account of the softness of the light transmitted. It has also been demonstrated that there is no difference between the transparency of marble to visible rays and invisible or ultra-violet rays. The light from the marble is pleasing to the eye; and this is due to the fact that the material, though more transparent than opaline glass for the visible part of the spectrum, gives passage to three to six times less energy than glass. As the visible rays enter to a very slight extent into the total irradiated energy, the conclusion is that marble is impermeable to the infra-red rays. Recent research shows that the infra-red rays are detrimental as well as the ultra-violet ray ones—they may be even more so where glass absorbs practically all the ultra-violet radiations. This seems to suggest that while eye-damage can, under any circumstances, be done by both, when the infra-red rays stand alone they are infinitely more dangerous than when companioned by the ultra-violet ones. But marble is an impassible barrier. When one comes to group together these excellent qualities of marble for neutralizing all that is bad in modern electric lamps, and accentuating all that is good, one can only ejaculate "Prodigious!" How thankful the electric lighting industry will be for marble.

Society of Engineers.—The annual general meeting of the Society was held at the offices, Victoria Street, Westminster, on Monday of last week. The report of the Council, which was adopted, referred to the amendments that are being made in the articles and bye-laws, and stated that the financial position of the Society was satisfactory. A list of members of the Society serving with the allied forces was included in the report. The ballot resulted in the following members being elected as the Council for 1915: President, Norman Scorgie; Vice-Presidents, Percy Griffith and Henry C. Adams; Members of Council, Henry Adams, C. T. Walrond, S. Cowper-Coles, B. H. M. Hewett, F. H. Hummel, G. A. Becks, F. L. Ball, W. B. Esson, G. O. Case, and W. N. Twelvetrees; Associate Member of Council, C. E. May; Hon. Secretary and Treasurer, D. B. Butler.

Water Purification by Ozone.—In the "Journal of Industrial and Engineering Chemistry" [Nov. 6, 1914] a brief description was given by Mr. R. W. Pryer of the water purification installation by ozone at Ann Arbor (Mich.). An abstract of the communication appears in the current number of the "Journal of the Society of Chemical Industry;" and from it we learn that the ozonizers are very similar to those of the Siemens-De Frise type, but an outer aluminium pole is used, mica tubes instead of glass, and no water-jacket for cooling. The filtered water is treated in wells from 8 to 9 feet deep; the ozonized air (containing on the average 0·5 gramme of ozone per cubic metre) being forced upwards under a pressure of 5 to 8 lbs., the ratio of ozonized air to water being about 1 : 2·2. During two years' working, at no time was any very considerable reduction of the number of bacteria observed. Usually the ozonized water contained more bacteria than before the treatment; and it was clearly proved that the *B. coli* was able to withstand the action of the ozonized air under the conditions described.

GAS AND WATER EMPLOYEES AND ENLISTMENT

On behalf of the Institution of Gas Engineers, Mr. Walter T. Dunn (the Secretary) addressed the following letter to the Secretary of the War Office, on a subject which is becoming increasingly pressing as time goes on. He has now received the subjoined authoritative reply, which will be welcomed by gas and water engineers who may find themselves confronted with a difficulty of the kind referred to.

The Secretary, War Office, Whitehall, S.W.

Sir,—The attention of the Institution of Gas Engineers has been called to the somewhat serious situation which has arisen in some districts owing to so many men in the service of gas undertakings having joined the Colours. Should this depletion continue, there will be difficulty in maintaining the public supply of gas.

While recognizing the great necessity for every available and suitable man joining the Army at the present moment, may I inquire whether the authorities have considered the advisability of providing for the necessary number of men being retained to carry on the operations for continuing the gas supply of the country?

Dec. 3, 1914. (Signed) Walter T. Dunn, Secretary.

W. T. Dunn, Esq., F.C.I.S., Secretary, Institution of Gas Engineers, No. 39, Victoria Street, Westminster.

Sir,—In reply to your letter of the 3rd inst., I am directed to inform you that recruiting officers have been instructed that on no account should *skilled employees* of concerns such as gas, electric light and power corporations, water-works, tramways, &c., be accepted for enlistment unless they are in possession of a certificate from their employers that their services can be spared.

In the case of those employed on *unskilled labour* reasonable time will be given for reliefs to be found from men who are unfitted for service before they are accepted.

(Signed) A. B. Gosset,
Major for Director of Recruiting.

War Office, London, S.W., Dec. 18, 1914.

THE GAS INDUSTRY AND THE WAR.

In Paris, as in London, writes a correspondent, it has been necessary, as a measure of safety, to reduce the public lighting, and in some quarters—for instance, in the neighbourhood of the Eiffel Tower—to suppress it almost entirely. The result has been that, coupled with the closing of the cafés at nine and the restaurants and theatres at eleven o'clock, a considerable diminution has taken place in the output of gas; the public lighting having been reduced by one-half, and nearly all that which may be characterized as luxurious suppressed.

From time to time the Paris Gas Company have very generously taken direct or indirect interest in many objects tending to improve the condition of the people; and their latest effort in this direction is particularly ingenious, and deserves mention. Some of our readers may be aware that in their show-rooms in the Rue de Maubeuge there are conducted courses of lectures and demonstrations in cooking by gas; and they are usually very well attended. We learn that at the present time the entire installation of appliances is being utilized, by the thoughtfulness and at the cost of the Company, in the preparation of soup and beef, which are supplied free to the holders of cards issued at the local municipal offices. The initiation and execution of the project are highly creditable to the Company and the Directors.

Out of just over 600 employees of the Bournemouth Gas and Water Company, 130 have joined the Colours. The Engineer and General Manager (Mr. Harold W. Woodall) was appointed Staff Captain to Major-General Elliott, but has since been promoted Major and second in Command of the Fourth Dorset Reserve Battalion with whom he sailed from Southampton on Saturday week *en route* for India. Two Assistant-Engineers (Mr. R. Irving and Mr. E. Broadberry) have received Commissions—one in the Gloucesters, and the other in the Seventh Essex Regiment. The Company make allowances to employees joining the Colours who have dependants to support. In the case of married men, they make up the army pay to the amount they received when at work, and in the case of single men to such amounts as best meet the special circumstances of the cases.

The larger portion of the Bourne Valley Gas-Works of the Bournemouth Gas and Water Company has been handed over free of charge for the accommodation of some 700 Royal Engineers of Kitchener's Army. The coal-stores are used as drill halls, the offices as staff headquarters, the gymnasium is a lecture-room, the mess-rooms are recreation rooms, and the old water-works reservoir is utilized for bridging and raft work. A large amount of emergency hospital work has been done on the twenty miles of coast-line administered by the Company. For the Indian wounded considerably over 500 ring-burners have been fixed in various Institutions for the cooking of their chippatee cakes. In

addition to this, hundreds of fires, cookers, and hot-water appliances have been fixed for general hospital work. As a result of all this, together with the stimulating effect on the slot-cooker consumption due to the billeting of nearly 20,000 soldiers in the district, the consumption of gas has increased enormously. On the Christchurch district, which has recently been taken over by the Company, the record increase for one day was 70 per cent.; and the average increase in the district since the hospital work and billeting commenced has been over 40 per cent.

In "The Times" for the 7th inst. it was stated that the following telegram had been sent by General Smuts, Minister of Defence, to the District Staff Officer at Kimberley: "Dec. 5. Please convey to Captain Bullock my congratulations on the splendid work which he and the motor squadron have performed in connection with the capture of General De Wet. Colonel Brits has assured me that, without their efficient assistance, the capture might not have been possible." It may be added that Captain Bullock is Manager for Messrs. Stewarts and Lloyds, Limited, in Johannesburg.

Mr. A. P. Wilson, the younger son of Mr. Alex. Wilson, the Engineer and General Manager of the Glasgow Gas Department, enlisted in September in the Third Glasgow Battalion (Commercial) H.L.I. He has now been granted a Commission in the Sixteenth Battalion (Second Glasgow) H.L.I.

Mr. J. G. Newbigging, junior, who has joined the Forces, is now at Epsom with the B Company of the First P.S. Battalion of the Royal Fusiliers.

Mr. Norman Greenwood Clapham, of No. 30, Queen Anne's Chambers, Westminster, the London and South of England representative of Messrs. Clapham Bros., Limited, of Keighley, has joined the Second Battalion of the London Scottish. Mr. Clapham is the younger son of Mr. Thomas S. Clapham, a Director of the above-named firm, and a past Chairman of the Council of the Society of British Gas Industries.

Mr. W. Ewart Brock, Engineer and Manager of the Denbigh Gas and Water Company, has just received a commission in the Territorial Army, being attached to the North Wales Company of the Army Service Corps.

About 35 per cent. of the employees of Messrs. Thomas Allan and Sons, Limited, of Bonlea Foundry, Thornaby-on-Tees, are serving with the Colours—some at the front, some in the Navy, and some with Kitchener's Army. There has recently been dispatched to each man a Christmas box containing woollen comforts, pipes, tobacco, cigarettes, chocolate, and writing materials. The cost has been defrayed by the Company, the officials, and the workmen jointly. The officials and workmen have also been subscribing weekly since the beginning of the war to the Prince of Wales's Fund.

It is stated, on the authority of Mr. J. R. Clynes, M.P., the Lancashire General Secretary of the National Union of Gas-Workers and General Labourers, that over 150,000 of their members have joined the Colours.

The Rhyl Gas Department are to be heartily congratulated on having provided ten men towards the new Army out of a total staff of 28—or 36 per cent. of the men employed. It would be interesting to know whether any British gas-works have done better than this?

It has, states a correspondent of the "Daily Chronicle," been decided to proceed with the Government scheme for making the British dyeware industry entirely independent of German supplies of synthetic dyes. The scheme, drafted under the authority of the Lord Chancellor and the President of the Board of Trade, originally provided for the formation of a limited company, with a share capital of £2,000,000, and for the issue of £1,000,000 of 4 per cent. first mortgage debentures, the interest to be guaranteed by the Government. Within the last few days, however, it has been arranged that the State's assistance will take the form of a loan of £1,500,000, at 4 per cent. interest.

The Secretary of State for India in Council has decided to withdraw, during the period of the war, the prohibition of the shipment of calcium carbide in vessels carrying Indian Government stores, subject to the observance of certain regulations. The responsibility for complying with the regulations rests entirely with the shipper of the carbide.

Producers of tar who dispose of their output to distillers have received the following communication from the Secretary of the Committee on the Supply of High Explosives, of which Lord Moulton is the Chairman: "With reference to your reply to my Committee's circular, I am directed to inform you that my Committee authorize you to continue deliveries of your crude tar to tar distillers. If you are proposing to renew your contracts, or negotiate new contracts with tar distillers, my Committee likewise have no objection to such action. With regard to small sales to other parties, they have no objection to deliveries being continued until further notice, provided that such sales do not, in the aggregate, constitute a substantial portion of your total output." The circular referred to in this letter was given on p. 623 of last week's "JOURNAL."

The Board of Trade call the attention of any persons who may hold shares or other property in trust for enemies to the provisions of Section III. of the Trading with the Enemy Act, 1914, under which such persons are required to give notice in writing to the Custodian by Dec. 27, and to furnish the Custodian with particulars. The Custodian for England and Wales is the Public Trustee, Nos. 3 and 4, Clement's Inn, Strand, London, W.C. The Custodian for Scotland is the Accountant of Court in Scotland, New General Register House, Edinburgh. The Custodian for Ireland is the Official Assignee in Bankruptcy, King's Bench Division, Four Courts, Dublin. Any person who fails to comply with the provisions of the section is liable, on conviction, to fine or imprisonment, or both.

The Greenwich Borough Council have written the South Metropolitan Gas Company calling attention to the greatly decreased consumption of gas in lighting the streets, and inquiring whether the Company propose to make any, and, if so, what, reduction in respect of the matter. A reply has been received intimating that a record is being kept of the lamps that are out of lighting; and it is proposed, in due course, to make a reduction in the charges in respect of unused gas, which is the only direction in which any saving is effected, the cost of maintenance, &c., being as heavy as though all the lamps were in regular lighting.

The Secretary of State's order for the Metropolitan Police District and the City of London, which would have expired at the end of this month unless renewed, was superseded last week by a fresh order. This differs from the previous order [*ante*, p. 286] in two particulars only:

(1) The use of any lights whatever for outside advertising or for the illumination of shop fronts is now prohibited. Formerly only "powerful" lights were prohibited, and the uncertainty as to what lights were "powerful" led to some evasions of the order.

(2) An entirely new provision is inserted, requiring all vehicles to carry, in addition to any head-lights which the existing law requires, a lamp which shows a red light to the rear. Experience has shown that this is necessary in the present condition of the streets to protect vehicles from being run into from behind.

It has to be particularly noted that this requirement extends to cycles and handcarts, as well as to other vehicles. The red glass reflectors so largely used by cyclists are no longer sufficient; a lighted lamp must be carried which shows red to the rear.

The following official announcement is made by the Board of Trade: The attention of the Board of Trade has been called to the fact that certain traders in this country do not appear to be fully aware of their obligations and responsibilities in regard to trading with the enemy. Traders are now by law expressly prohibited from obtaining from, or supplying to, an enemy country, or an enemy, either directly or indirectly, any goods, wares, or merchandise; and it is incumbent upon them to take every precaution to see that goods which are exported to a neutral country are not ultimately destined for an enemy country, and that goods which they import from a neutral country are not of enemy origin. The Board of Trade do not doubt that reputable British firms are in general careful to avoid infringement of the Proclamations relating to trading with the enemy; but they have reason to fear that in some instances there have been cases of business laxity, and that goods have reached this country, or have been exported from it, which proper inquiry would have shown respectively to have been of enemy origin or intended for enemy consumption. Any such laxity or want of proper inquiry renders firms liable to the risk of prosecution under the "Trading with the Enemy Act," the penalties imposable under which may be either fine or imprisonment, or both, and if the conviction is under indictment even penal servitude, with forfeiture of the goods in either case.

The Late Mr. Henry Austin.—The funeral of Mr. Henry Austin, one of the first Employee-Directors of the South Metropolitan Gas Company, whose death was recorded in the "JOURNAL" last week, took place on the 12th inst., at Charlton Cemetery; the Rev. H. G. Hills, Vicar of Holy Trinity, Bromley Common, and formerly of St. Andrews-with-St. Michael, East Greenwich, officiating. In an address the reverend gentleman (who attended especially to take the service), after coupling Mr. Austin's name with that of the late Sir George Livesey, spoke in high terms of his good work in many directions. Among those present were Mr. Charles Carpenter, D.Sc. (Chairman), Mr. Frank Bush (a Director), Messrs. Cupit, Newbold, and Waterer (Employee-Directors), Mr. F. M'Leod (Secretary), several officers, all the foremen, and many workmen of the South Metropolitan Company.

THE LATE M. DELAHAYE.

We have received from an esteemed correspondent the following particulars of the life-work of the late M. Adolphe-Philibert Delahaye, which will supplement those that were given in the "Journal" last week.

When M. Delahaye joined the Société Technique du Gaz en France in 1882, he was connected, in an administrative capacity, with the gas company which then supplied the suburbs of Paris (the Gaz de la Banlieu). He was elected a member of the Committee in 1890, was Vice-President in 1894, and, as mentioned last week, President in 1897. Almost every year he presented at the congresses of the Society the results of his interesting investigations into the subjects of electric lighting, competitive systems of illumination, and the reduction of the price of gas (the subject of his Presidential Address at the congress at Nice), and comparative statistics as to gas and electricity. He was Vice-President of the Commission for the Gas Exhibition in 1900; and, in his capacity of General Secretary, he had to organize the International Gas Congress held in Paris that year. He was also Secretary of the International Commission on Photometry, and a member of the French National Lighting Committee. After the Franco-Prussian War, he became Secretary to M. Hippolyte Fontaine on the "Revue Electrique," and while so engaged he produced some very incisive and remarkable articles which qualified him for taking the position of General Manager of the "Journal des Usines à Gaz," which till his death in 1885 had been filled by M. Servier.

M. Delahaye published from 1884 till 1891 the "Année Electrique," containing an account of the scientific works on electricity, and the inventions and principal applications relating to it. He also produced two works of a popular character which were very successful—viz., "Lighting in the Town and in the House" (1887) and "Applications of Gas" (1890).

In his capacity of General Secretary of the Syndicat Professionnel de l'Industrie du Gaz, M. Delahaye was always ready to render assistance. He was thoroughly posted up in gas literature, and was constantly consulted, not only on technical but on administrative and legal questions. The extent of his knowledge and the soundness of his judgment caused him to be accepted as an expert by the Tribunal of Commerce for the Seine. He was also consulted as an expert in connection with many gas matters, both in France and abroad.

M. Delahaye possessed a keen and original mind, was singularly well informed in regard to men and things associated with gas, and held a high place in the industry, in which he figured in the three important capacities of engineer, consultant, and journalist. He was held in great esteem by his colleagues.

PERSONAL.

Sympathy will be felt for Mr. William Gadd, who is suffering from an accident sustained some weeks ago. On the 12th ult., he was knocked down by a tramcar near his own garden gate, and was a month in bed, from consequent concussion. It is a pleasure now to be able to report that he is so far progressing towards recovery that he is able to be up for some hours each day. Naturally, as Mr. Gadd is in his 77th year, recovery from such a shock is slow; but his friends will join with us in expressing the hope that it may at the same time be sure.

Councillor William Kay, the Chairman of the Manchester Corporation Gas Committee, was last week entertained at dinner by the members of his Committee in the Town Hall. The Lord Mayor (Alderman M'Cabe) attended, and joined with Alderman Bowes (who was in the chair) and other members of the Committee in voicing appreciation of Mr. Kay's services. The Gas Committee's progressive policy under Mr. Kay's lead had, it was pointed out in the speeches, resulted in a marked development of the gas undertaking. At the same time, gas was now being sold at a cheaper rate than it had ever before been sold in the city.

OBITUARY.

It is reported that Herr Georg Wiese, the Manager of the Harburg Corporation Gas and Water Works, died, after a long illness, on the 20th ult. Deceased had been Manager of the Harburg Gas-Works since 1892; and in 1894 the water-works were also placed under his charge.

The "Journal für Gasbeleuchtung" of the 5th inst. reports the death on the battlefield of Dr. Leoni, the Assistant Town Clerk of Strasbourg. Dr. Leoni acted as Chairman of the Local Committee on the occasion of the annual general meeting of the German Association of Gas and Water Engineers at Strasbourg last year.

The death took place on the 22nd ult of Mr. Gordon Walker, the highly esteemed Manager of the Wantage Gas-Works, after an illness of only a few weeks' duration. He was 54 years of age, and was appointed Manager at Wantage in 1890, having formerly been Manager of the Westbury and Melksham Gas-Works. It is a coincidence that the loan which was taken up by the Urban District Council (then the Town Commissioners) in 1879 should have been finally discharged this year. Mr. Walker was a sergeant in the Wilts Volunteers, and won the long-service medal. He was also well known as a Freemason, and was one of the founders of the Loyd Lindsay Lodge No. 3058. From its formation, he acted as Secretary; and it was a proud boast of his that he never missed a meeting of the Lodge until his last illness prevented his attendance. He also held the office of P.P.G.J. Deacon of Berks. Deceased leaves a widow and four children.

THE DUTCH GAS-MANTLE INDUSTRY:

THE WAR AND INTERNATIONAL TRADE.

An interesting communication is to hand from a correspondent in Holland who is in an exceedingly good position to gauge the real position of Dutch producers and suppliers of gas-mantles for the English trade. It will be well to reproduce, in his own words, the information he sends.

"The other day, he writes, Mr. Marsh, at the meeting of the Society of British Gas Industries, made a complaint as to German mantles being imported into Holland for the purpose of transit to the United Kingdom under Dutch colours. Whether or not this be the case, is a point the discussion of which is entirely fruitless. One need only remember that in Amsterdam and Rotterdam there are British Consuls—pure genuine Britons—who are exceedingly careful as to the carrying out of the "Enemy Trading Act." No foreign goods are allowed to be imported into the United Kingdom or its Colonies without the consent of the British Consul. And the English Consuls in our two Dutch shipping ports take their duties very seriously.

First as to the point of whether there is such a thing as a Dutch gas-mantle industry. When the political heaven was still unclouded, and the sun of peace was shining brightly, there were in Holland several mantle works of smaller and greater producing capacity. In Amsterdam, there were at least three. Then there were factories also in Amersfoort, Arnheim, Rotterdam, Enschede, and Venlo—the latter being a Dutch-Belgian society. Also there was a branch of a Swiss firm making braided mantles with ribs. Most of these factories are several years old. In early times, a great deal of the materials used in the industry was imported from Germany, as was the case with the thorium, the fabric, and so on. But in course of time the Dutch have learned that, by manufacturing these materials, there is also to be gained a nice profit. Collodion was already manufactured here by several chemical works; and afterwards knitting machines were installed, and most firms now make their own fabric. Some years ago, the Enschede cotton men got the idea that there is also a profit to be made by spinning ramie, and so the Ramie Union was established. This firm gets its fibre from the Dutch Indies; and so the material is pure Dutch produce. This firm was a great rival of the Emmendingen works; and the Germans took great pains to capsize this rival, but without success. The Enschede men are "cut from the same wood" as the Manchesterians; and so there is no wind that does not blow them some good. The same holds good of the Enschede Cotton Spinning Mills, which are capable of meeting all demands in yarns for knitting mantles. The Dutch mantle industry is totally independent of foreign countries in the matter of fabrics. Even artificial silk is made at one large factory in Arnheim. This firm is also genuine Dutch, as there are among the shareholders a couple of chemical professors of Dutch Universities, and also a lot of tradesmen whose ancestors were already Dutchmen in the times of William the Third.

Now as to the boxes for putting the mantles in. In Amsterdam, the general industry was developing very rapidly before the war broke out. There were at least two firms making mantle boxes, together with other sorts of paper and carton products. One mantle works in Amsterdam has its own box-manufacturing machines, adequate for the production of many thousand boxes a day. Therefore in practically everything the Dutch mantle industry is independent of Germany.

What is now, in these times, the general situation in trade? The first weeks of the war found trade and industry in Holland lamed in many respects. But very soon the opinion became general that the German export industry and export trade had got such a severe set-back that many places had become vacant on the world's markets. The result was a revival of interest in trade, and in the production of such goods as need no extensive plants nor big capitals. What the English intend to do with their chemical industry, the Dutch will be able to do as well; and therefore the increased export of mantles from Holland ought not to be taken as attempts to evade the "Enemy Trading Act," but as symptoms of the awakening of Dutch national industry.

Long-Distance Transmission of Coke-Oven Gas.—This subjec was dealt with by Herr R. Witzeck in a recent issue of the "Journal für Gasbeleuchtung;" and the article is briefly noticed in the current number of the "Journal of the Society of Chemical Industry." The author discussed the history of the coke-oven and its development into the modern regenerative form, with bye-product recovery; and he showed that there are advantages in manufacturing in a large oven, situated in a coalfield, and distributing through considerable lengths of pipe, over manufacturing on the small scale near the consumer.

PRESENTATION TO MR. EDWARD ALLEN.

An interesting event took place last Friday at the offices of the Liverpool Gas Company, when Mr. Edward Allen, M.Inst.C.E., the Engineer of the Company, was presented with a set of silver entrée dishes by his staff, as a token of their respect and esteem on the occasion of his completion of fifty years' service.

All the superintendents of the works and departments were present; also members of Mr. Allen's personal staff. The proceedings were presided over by the Assistant-Engineer of the Company, Mr. R. E. Gibson; and the presentation was made by the Senior Superintendent, Mr. T. N. Godden, of the Wavertree works, who was supported by Mr. M. C. Telfer, the Superintendent of the Street Department. Testimony was borne to the kindness and consideration Mr. Allen had always shown towards those under his control, and to the warm regard and affection in which he is held by all the members of his staff. Reference was also made to the great improvements introduced by Mr. Allen in the manufacturing plant under his charge, by the adoption of modern systems and labour-saving appliances, and to the great honours which had been so deservedly bestowed upon him in recent years. The hope was expressed that Mr. and Mrs. Allen might long live to use the gift which had just been presented.

Mr. Allen, in reply, paid a tribute to the valuable help he had always received from the various members of his staff in carrying on the work of the Company.

The gift was suitably inscribed, and bore a monogram together with the two dates 1864 and 1914.

A PHOTOGRAPHIC TESTIMONIAL TO BRITISH FIRE-CLAY RETORTS.

During the year 1904, Messrs. W. J. Jenkins and Co., Limited, of Retford, built some retort-settings at the works of a Gas Company (which must here be nameless) of which the accompanying photographs show two representatives after ten years of strenuous work. The Engineer of the Company, on having the settings dismantled for renewal, was so struck with the condition of the retorts that he decided, in view of the charges levelled a time ago against British-made fire-clay retorts, to let these settings bear photographic testimony to their good structural condition and behaviour to the end of their working days. The heats in the retorts have been in the vicinity of 2000° Fahr.

The life records of the settings are: For the one shown in the upper photograph (No. 9 setting):

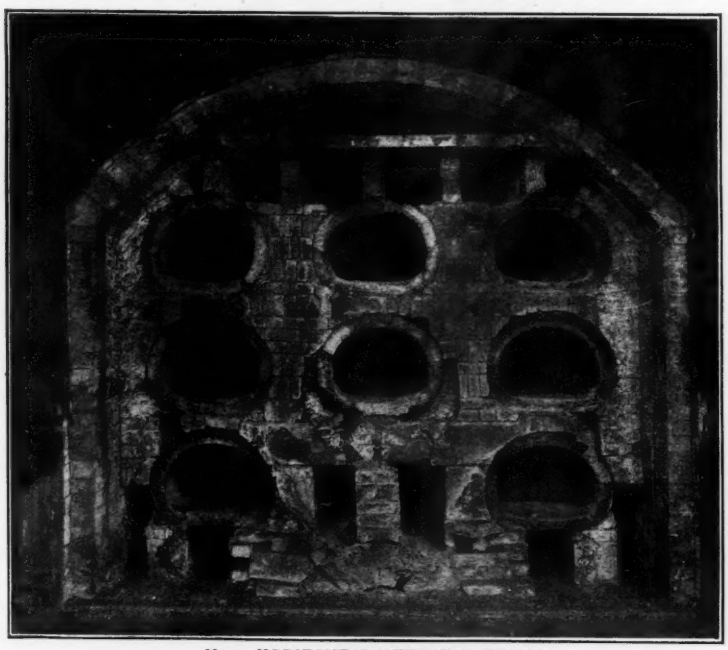
No. 9 Setting (Horizontal).

Charged or Shut Down.	Date.	No. Days Worked.
Light charges put in . . .	16.11.04	.. —
Taken over for regular work.	18.11.04	.. —
Shut down for extensions during summer	13.7.05	.. 238
Taken over for regular work	17.3.07	.. —
Shut down	29 9.08	.. 407
Charged and taken up. . .	8.10.01	.. —
Shut down	11.10.08	.. 3
Taken up	9.9.10	.. —
Shut down	4 9.12	.. 726
Taken over for regular work.	23.9.12	.. —
Shut down for renewal . .	23.9.14	.. 730
Total		2104

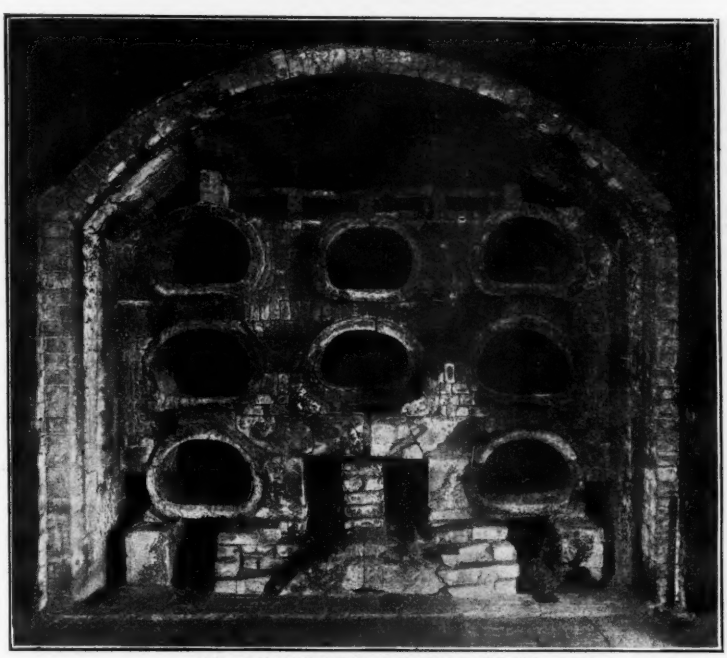
For the setting (No. 10) shown in the lower photograph:

No. 10 Setting (Horizontal).

Charged or Shut Down.	Date.	No. of Days Worked.
Light charges put in . . .	11.11.04	.. —
Taken over for regular work.	18.11.04	.. —
Shut down for extensions during summer.	13.7.05	.. 238
Taken over for regular work.	17.8.07	.. —
Shut down.	29.9 08	.. 407
Charged and taken over . .	8.10.08	.. —
Shut down.	5 11.08	.. 26
Taken up	9 9.10	.. —
Shut down.	22 2 12	.. 531
Taken up	18 9 12	.. —
Setting let down.	30.3.13	.. 192
Taken over for regular working	27.9.13	.. —
Shut down for renewal . .	23.9.14	.. 361
Total		1755



No. 9 HORIZONTAL RETORT-SETTING.



No. 10 HORIZONTAL RETORT-SETTING.

According to a paragraph from a French source in the current number of the "Illuminating Engineer," the total consumption of gas-mantles in the world is 300 millions annually, of which approximately 50 millions are used in France, where about half this number are produced.

We have received from Mr. Edward Arnold a copy of a work entitled "The Rare Earths: Their Occurrence, Chemistry, and Technology," the price of which is 10s. 6d. net. It is intended that a review of the book shall be published in a subsequent issue of the "Journal."

ENGLISH GAS-WORKS UNDER FIRE.

EARLY last Wednesday morning, the Hartlepools, Scarborough, and Whitby were subjected to a bombardment from ships of the German fleet which resulted in grievous loss of life and personal injury, and much damage to English property and German reputation. Each day since the occurrence the death roll has been swelled, owing to the terrible nature of the wounds sustained by many of those who were not killed outright. On Saturday, "The Times" stated that at the Hartlepools alone the number of deaths was expected to reach a hundred—nearly all civilians; and the terrible list is considerably swelled by the fatalities at Scarborough and Whitby. Among the wholesale devastation caused by the shells, it was too much to expect that the gas-works would remain unscathed.

Photo. by "Daily Mirror."

A GASHOLDER AT HARTLEPOOL STRUCK BY SHELLS DURING THE GERMAN BOMBARDMENT LAST WEDNESDAY.

Early intimation that something serious was amiss was afforded to the residents of Tynemouth by the issue on Wednesday morning of the following warning: "Notice is hereby given that the Tynemouth Emergency Committee are advised by the Military Authorities to have the gas turned off at the works at once, for military reasons. There is a rumour that a battle is now proceeding in the North Sea; and there is a probability of a hostile attack on Tynemouth." Fortunately, in the event, Tynemouth escaped altogether.

At Whitby, which suffered less from the attack than the other two places, no damage was done to the gas-works themselves. While saying that Whitby suffered less than Scarborough and the Hartlepools, this is, of course, meant merely to apply in a comparative sense. As a matter of fact, Mr. W. M. Galleway (the Secretary and Manager of the Gas Company) informs us that during the quarter-of-an-hour the town was under bombardment tremendous damage was done by the 150 or more shells fired. It was evident that the gas-works, though they escaped injury, were one of the points of attack, as a considerable number of shells fell in the vicinity, but wide of the mark. On a subsequent examination of the works, Mr. Galleway found a piece of shell on the top of one of the holders. The plate was dented, but not pierced. A 3-inch main was broken by a bursting shell, but without injury to life or property. Immediate steps were taken to temporarily repair this, and make an examination of the wrecked property for possible escapes of gas. None of the Company's employees was injured.

It was at Hartlepool that the bombardment was most severe; and here the chief damage to gas-works occurred—resulting in the publication in Thursday morning's papers of the following: "The Directors of the Hartlepool Gas and Water Company, while they much regret the inconvenience caused consumers by reason of the bombardment of their works, desire to announce that all that can possibly be done to restore the supply is being hastened; and they hope to be able partially to resume the supply to-night, and to give a fuller, if not normal, supply to-morrow." From this it will be gathered that the town was temporarily deprived of its gas supply. This interruption was primarily caused by the damage to the three holders, the escaping gas from two of which caught fire. The accompanying photograph of one of these holders shows what it looked like after the town's experience of German "warfare." Mr. A. W. Branson (the Engineer of the Company) writing on Friday, stated that, unless there was some damage below the water-line which he had not then seen, he hoped to get one of the holders, having a capacity of 750,000 cubic feet, into work before that night, and so start a supply of gas. It meant the patching-up of shell-holes. One of the other holders was struck on the crown, and the third in the side. One is hopelessly smashed up, and will take months to repair; but the other, with a capacity of 1,500,000 cubic feet, is not quite so badly injured. No serious damage was done to the plant, although the buildings were very considerably damaged. Gas making was stopped at once, though it could have been carried on without interruption if there had been any storage. Seven or eight of the men were injured, some of them seriously; and unhappily one has since died. Mr. Branson states that about twenty shells fell on the works. He was in his house opposite when the bombardment started, and immediately proceeded to the works. Damage was also done to the buildings on the water-works (of which Mr. Branson has charge); but the chief injury to the plant was the cutting of a steam-pipe, which resulted in the stopping of the pumps. This, however, was quickly put right. There was no damage to gas-mains by shells exploding in the streets. There was, however, the danger of escaping gas in the damaged houses; and the gas was cut off in these cases where necessary.

The Scarborough Gas Company, in the midst of destruction, came off remarkably well; the only damage sustained by their property, we learn from the Manager and Secretary (Mr. A. Philip Allan) being the penetration of a sheet of a holder by a splinter of shell, which caused the loss of 10,000 cubic feet of gas. The escape of the works is rendered all the more extraordinary by the fact that all round them it was found exploding shells had caused holes about 8 feet diameter and 4 feet deep. Mr. Allan had at home a very narrow escape, as a school which is just across the road was struck by a shell and practically demolished inside, as also were a large number of other houses near. All the plant at the works was kept running during the bombardment; and immediate steps were taken to attend to any damaged pipes—a visit being paid to every house struck. It may be mentioned that the Company are ensured at Lloyd's against war risks.

In accordance with the Home Office Order, the Birmingham Lighting Committee last week resolved that all street-lamps in the city should be obscured.

ELECTRICITY SUPPLY MEMORANDA.

CHRISTMAS is always a favourite time for the issue of warnings against electrical decorative work in shop windows. Grim trouble has arisen from the practice. The season this year is not being honoured much by special decorative display in shop windows. We are in too close touch with tragedy for any indulging in the fullest measure of Christmas merriment and festivity. Shopkeepers realize this; and so there are not the usual signs, or not to such a large extent, of the customary Christmas attractions in the shop-windows. Even if tradesmen were minded to embellish and enliven their shop-windows by additional light, the hard-hearted powers that be would not assent. Raids by water may be followed by raids by air if the elements permit. Still through the very regulation imposed by the resolute powers that be, there is something in the nature of an involuntary attempt at Christmas decoration. Some shopkeepers who have not concealed lights top or bottom of their windows or in both situations, or have not regulatable incandescent gas-lamps, have adopted, to obtain a reduction of illumination, the method of robing electric-lamps in coloured tissue paper. It is a make-shift and most dangerous arrangement. Mr. F. W. Willcox, of the British Thomson-Houston Company, has written to the electrical journals calling attention to this paper robing as providing not only an ineffective form of illumination, but "a distinct source of danger, as witnessed by the large amount of badly scorched tissue paper seen." The "Electrical Review" urges its readers "not to forget the terrible fire at Messrs. Arding and Hobbs' in 1909." "One such experience," it remarks, "is enough." It happens that there have been many other experiences of a similar character; but the Clapham one by its fearful destruction of life and property stands out in memory beyond these many others.

Tissue Paper Dangers.

The consumer of electricity has quite a number of things upon which he is bidden to keep a watchful eye to prevent trouble. Flexible connections are members of an electrical installation which may cause him some doubt on the point of safety, if his eye happens to meet the conclusions drawn by Messrs. Melsom and Booth from experiments made with electric flexible wire, at the National Physical Laboratory, for the Wiring Rules Committee of the Institution of Electrical Engineers. Their main conclusion is that it is desirable to periodically renew the flex used for ordinary pendants and small heating apparatus before it presents any outward and visible signs of deterioration. This increases the responsibility of the user of flex. If there be no visible or other signs, how is he to judge that the time is ripe for renewal? The investigators do not explain. Evidently the user is expected to fix upon some arbitrary length of life, and then at once renew. "Electrical Engineering" has drawn on the "Journal of the Institution of Electrical Engineers" for information as to these experiments; and we are obliged to our contemporary for doing so. Measurements were taken of the rise in temperature of the flex due to the heat arising from pendants with various classes of shades, irrespective of that due to the ordinary losses in the wire. In a number of cases the heat from 55-watt lamps sufficed to increase the temperature at the cord grip by 43° Fahr., or about twice the temperature-rise allowed by the wiring rules for rubber insulation. Examination of the wire showed that the rubber was practically destroyed, and, in the case of silk-covered wires, the covering was weakened. Experiments made with a large number of different classes of electrical heating apparatus demonstrated that reliance should not be placed upon rubber insulation on connecting wires within the apparatus, except possibly in the case of small radiators. With such things as electric-irons and hot-plates, the rise in temperature of the flex within 3 or 4 inches of the connection sockets was usually considerably in excess of 30° Fahr., which, assuming the maximum air temperature of the room to be 80° Fahr. and the rise due to C^2R loss in the wire 10° Fahr., brought the actual temperature to 120° Fahr.—the accepted safe temperature limit for rubber.

Flexible Troubles.

The hire system in connection with domestic gas appliances has been developed to such an extent that there is not much room in making one's friends presents of such small, light, and choice articles as gas-cookers and gas-fires, although there are few things more useful at this season of the year. The gas-iron might perhaps be introduced as a Christmas present; but there is precious little else that could be adopted for this particular purpose. The hire system in connection with the electrical industry has not been adopted or developed to the same extent as in the gas industry; and so our friends have a few more things that they can offer as Christmas gifts, though the appropriateness and propriety of some of them are open to question. The matter has been discussed in the "Electrician." Electric toasters, chafing-dishes, teapots, coffee percolators, shaving-pots, irons, radiators, grillers, and so forth are mentioned. There is no objection to some of these things being made use of as presents, though inefficient, and causing an increased use of dangerous flex. The Chief Electrical Inspector of Factories and Workshops has often had something to say about the ability of the electric-iron to cause the user to hop, skip, and jump, and for it to become even more dangerous than that. Therefore the propriety of an electric-iron as a Christmas gift is open to question. And as to the electric-radiator, say a four-lamp one running away with a unit of current per hour, and giving evidence of its presence by its glow rather than by its radiant heating efficiency, well it is, to say the least, unkind to give an example of uneconomy and inefficiency as a Christmas present.

Christmas Presents.

The electricity supply scheme of the London County Council is, of course, a very big affair, and one the details of which cannot be assimilated all at once. The Parliamentary Committee have obviously found it expedient to place the project in progressive doses before the Council, which indicates that, at the time it was originally brought to the front, the details had not matured, nor had they been thoroughly and conclusively considered by anyone on behalf of the Council. The Council seem to be going about this business in a sort of rush; and it would have accorded better with dignity and business method if there had not been this eleventh-hour pressure, with the convenience of all outside authorities completely ignored. The more light there is thrown upon the scheme, the more its complication is brought into relief. Its general outlines are known to readers of the "Memoranda;" but the filling-in has been proceeding, and something fresh springs into knowledge with every mention of the subject at the Council meeting. The Parliamentary Committee again reported on the subject of the Bill last Tuesday; but up to the present, so far as we can gather, the Committee have not taken into their deliberations the five county councils and the three borough councils who are to contribute to the formation of the public authority who are destined to take the place of top dogs in this remarkable scheme. The involved outside local authorities are evidently expected to be very grateful that they are to be admitted into the scheme at all; but, though admitted, they are not to be a very potent force. They may bark, but that is to end their effective membership. For the new authority representation is to be proportionate to assessable value; and the result is that the London County Council will swamp all the other authorities. There are 27 members proposed, of whom the Council claim eighteen. The Middlesex County Council are granted two; and the Essex, Hertfordshire, Kent, and Surrey County Councils, and the East Ham, West Ham, and Croydon County Borough Councils are also to have one each. Thus two-thirds of the representatives will be there as delegates of the London County Council. There is a further provision in the scheme that the members of the authority need not be members of the appointing authority, with this exception that, in view of the financial and other interests involved, half the representatives of the London County Council, it was suggested, should be members of the body. From this alone, it is seen that the Parliamentary Committee meant the Council to have a good controlling place in respect of the acts of the new body. But even this provision did not satisfy the Council when the report came before them; and an amendment was passed that of the total of twenty-seven members forming the authority, fourteen should be members of the Council. This at once gives the Council a positive control in practically everything.

The London Scheme Sanctioned.

The scheme is regarded by its promoters as an excellent one, blending as it does municipal ownership and the ability and advantages of company operation. We doubt the expediency of the ownership, and of the poking of the nose of the Council into this matter at all. It is, however, one of the best testimonials that company administration has ever had when it is admitted (not by the Progressives, but by a majority of the Council) that the whole electricity supply of London is better safeguarded under a company than under a body such as the Council, the membership of which is inconstant. Regarding the proposals subsequent to constitution, a *résumé* of the report is given in our "Miscellaneous News" columns. They refer to the transfer of undertakings within the area, the delegation of the powers of the authority to the operating company, the supply of energy to the existing authorized undertakings, the supply where there are no authorized undertakings, compulsory purchase of scheduled sites for large generating-stations, and all the authorization in connection with distribution and supply. The maximum price for bulk or power supply is not to exceed a fixed sum of £3 10s. per KW. of the maximum power required to be supplied, with an additional ¼d per unit. For bulk or power supply, these figures are not looked upon as remarkably low even if the £3 10s. is an annual charge and not a quarterly one. The period for which it is proposed to transfer the powers to the operating company is not to exceed fifty years. There are also conditions as to the authority approving of the company's capital expenditure, and of contracts during the last ten years of the company's existence. The Bill also sets the limits to the capital provision of the authority. They may find any money required for special expenditure for the purchase of any existing electricity undertaking, and not exceeding two-thirds of any other capital expenditure. It is evident that finance is going to be on the grand scale; seeing that the authority take powers on their own account to expend 10 millions sterling, as well as further sums required for purchasing concerns,

Municipal Ownership and Company Management.

and for advances to authorized undertakings, in addition to sums sanctioned by the Board of Trade. This we take it excludes the capital raised by the Company. Commended to the attention of readers, too, is the information given elsewhere as to the division of the net revenue. It is very clear that, after all the claims have been satisfied, there will not be much remnant profit available for giving, as contemplated, rebates to consumers and for the relief of the rates. After satisfying the interest, sinking fund, and provision for reserve, any further profits "are to be divisible between the authority and the company in manner to be prescribed by the deed of transfer until the company receives a share sufficient to pay further dividends upon its capital expenditure, making in all a return of 8 per cent. interest to the Company. Any further profits are to be utilized in giving a rebate on the prices charged to the consumers, in relief of the rates," &c. There will be, if we mistake not, a good deal of destructive criticism levelled at this provision, as forecasting some unlikely eventualities. The establishment of a small technical committee is provided for in the Bill. It is not quite such a serious matter as was previously suggested; but it all contributes to the production of the complexity for which the scheme patently provides, though its authors repose in the confident belief that they have done something really grand and almost absurdly simple. Some shrewd observers firmly believe that, if Parliament is so much engrossed with other affairs as to let this scheme through, it will be found that the electricity affairs of London will be in a greater pickle than ever.

Lining-up the Borough Councils.

The opposition to the scheme gathers strength, which is not very astonishing. The Borough Councils who are disinclined to part with their electricity supply concerns see that, if the measure succeeds in its present form, they would not have a soul to call their own. Dominating such councils in relation to their electricity concerns would be the central authority; and the chances are that freedom in administration would be so curtailed that the borough councils would be forced into complying with the object of the promoters of the scheme, and so allow of an early absorption, instead of waiting for the effluxion of their statutory life in 1931. But they are evidently rounding themselves up for a detailed criticism of the scheme when it comes before Parliament; and they have good hopes of destroying it. There seems to have been a great want of diplomacy in the preparation of the project, but, flattering Germany's crowned head, a distinctly Kaiser-like attitude on the part of the Council. The Hammersmith Council are taking the lead in the Borough Council's opposition; and an extensive report on the subject has been prepared by the Town Clerk. Of course, the new authority will not supply in the areas of existing and continuing undertakings, without the consent of the borough councils or companies; but it is desired that the authority shall in connection with existing undertakings have final voice in determining such things as standards of periodicity, voltages, and the systems of generation, transmission, and distribution and supply. That is to say, the judgment of the Local Councils in regard to technical matters, and apparently certain commercial ones, are to be entirely subject to the confirmation of the authority, or to superseding prescription on the part of the latter. The idea, of course, is the standardization of the supply throughout the Metropolis, which, under existing circumstances, would negative all individual judgment outside the authority as to what is best for any particular locality. Then extensions, enlargements, &c., it is intended shall be subject to the approval or control of the authority before sanction is given to the raising of capital.

Responsibility without Representation.

Naturally, too, there is a strong dislike to a proposal that any deficiencies of revenue shall be apportioned among county councils, county borough councils, or other authorities of boroughs or districts in the area of supply. It is suggested that even those bodies that have no representation on the authority shall take upon themselves obligations in respect of stocks, securities, and moneys issued or raised, and contribute towards, or assist in, defraying the costs and expenses for the purposes of the intended Act. The authorities who have not representation, and those who have (in view of the preponderating weight of the London County Council) will be strongly opposed to any such provision, with the Council, the Technical Committee, and the operating Company controlling the management, and probably at times pulling in contrary directions. The proposed management of the big venture, as well as the financial arrangements generally, do not appeal to us as being by any means the best for avoiding deficiencies. It is also considered, according to the Hammersmith report, that such a gigantic capital as the one proposed, being largely supplied from public moneys, should not be placed under the control of a company. There is not much in this particular objection, seeing the tight controlling hand the Council are retaining for themselves. If the Council had deliberately set out with the idea of antagonizing all concerned in this scheme, they could not have pursued a more eminently successful way. In the Hammersmith report, it is suggested that the problem of the electricity supply of London could well be solved by the development and co-operation of the existing undertakings; and it is submitted that there is no reason why, if Parliament thinks it necessary, the municipal electric supply authorities should not provide a bulk supply for London, controlled by a Joint Committee of those authorities. We wonder how far the County Council will go with their curious scheme, or whether they will really proceed the full length in trying their luck in face of an allied force the like of which it seems probable will not find a precedent even in the opposition aroused when last the Council were in Parliament establishing their place in the future of the electricity supply of London. The Council are at the moment inclined to risk something.

GAS SUPPLY IN THEORY AND PRACTICE.*

Among recent books sent for review is one, of some 200 pages, bearing the above title, written by Mr. W. H. Y. Webber, giving for "officers and skilled workmen engaged in the practice of gas supply fitting" an "epitome of sound principles and a condensed description of approved methods of carrying out the ordinary work of this department of British gas undertakings." The quotations are made from the preface, since they more fitly indicate the purpose of the book than does the statement on the title page—"a simple guide for the gas-fitter and gas consumer."

There is much in the book—matters such as regulation of district pressures, meter repairs and testing, street lighting—which may academically interest, but does not practically concern, the ordinary gas-fitter, still less the gas user. The greater part of the work, however, will be of service to all engaged in gas supply, whether connected with a gas undertaking or with a private fitting firm; and it will be a useful guide to the skilled gas-fitter who wishes to take an intelligent interest in the principles underlying, as well as in the execution of, his work. It is not intended to impart instruction to fitters in the usage of tools or the practice of their handicraft. These are necessarily assumed, as, indeed, is a certain amount of scientific knowledge.

The first few pages of the book are devoted to the question of pressure, since, as the author intimates, it is axiomatic that "good pressure means good gas to the consumer," with a relative absence of complaints. A district pressure, therefore, should be maintained which will give at the user's appliances a uniform 20-10ths.

Following the calculation and table of velocities of discharge of town gas, and generalizations from the Pole formula as to the delivering capacity of pipes, the book naturally comes to the considerations affecting the supply of gas to consumers. In the formula as quoted, the pressure has been denoted by the familiar letter "h"; but this may cause some confusion to the student, since it is replaced later in the explanatory phrase that "P = pressure loss in inches." It might have been incidentally stated that this formula is applicable to gas at ordinary pressures, and must not be taken too confidently for gas supplied at high pressure. In the application of the calculations it should be noted that some allowance is necessary for future requirements, and also for possible corrosion of pipes. That this is not clear is indicated by the author's example of a service pipe to a house where the gas appliances involve a maximum consumption of 200 cubic feet per hour. The size of the meter is given as 20-light, and the service, by calculation, as 1 inch. The meter connections are 1¼ inches; and it is suggested, although not stipulated, that this size of pipe might be safer. The main cock, however, need be only 1 inch. This example, given presumably as a guide, is not in the interests of gas undertakings. The tendency, on the part of private gas-fitters at any rate, is to err on the low side; and here, both as regards meter pipe and tap, they are encouraged in this direction, and may be tempted to disregard the regulations issued by gas undertakings, which usually state that the meter connections are to be the guide as to size of the outlet pipe.

The principal part of Mr. Webber's lecture delivered at last year's National Gas Congress and Exhibition, on the construction, testing, and reading of meters, is included. One would have liked, in a small handbook such as the one under consideration, to have seen this somewhat condensed, and some of the 28 pages spared for discussion of other phases of work with which gas supply fitters are more immediately concerned. The next section of the book affords an example where such discussion would have been useful. Ten pages of letterpress and illustrations are not too much to devote to the practice and rules governing the internal piping of houses and other buildings. Little or nothing is said of the piping of shops, halls, works, &c., and fuller information as to the accurate proportioning of pipes and their branches would be welcome to some fitters. There is only one example in the book; and this is insufficient to cover the numerous cases which arise.

Mr. Webber gives no particulars of the sizes and weights of lead and compo. pipe, apparently considering that its use is "not now good practice." As a matter of fact, compo. pipe is being used very extensively by the trade for internal piping, and especially where additional points are required as in the case of gas fires and cookers. In view of this, his suggestion of a ⅜-inch pipe feed to a gas-fire should be explained to mean *internal* diameter. The same remark refers to the length of ¼-inch pipe shown.

The best and most interesting portion of the book is to be found in the author's discussion of the principles underlying the

* "Gas Supply in Principles and Practice: A Simple Guide for the Gas Fitter and Gas Consumer." By W. H. Y. Webber. London: Whittaker and Co.; 1914.

combustion of gas, and the development of luminous and heating efficiency. The pages dealing with these and the *rationale* of incandescent gas lighting by vertical and inverted burners, served both by low and high pressure gas, with some description of methods of shading, will well repay close attention by students, and will happily refresh the memory of others. Equally will they give to the gas-fitter a better understanding of the theory governing gas practice; and his comprehension of this, and attention to the practical hints given, should certainly make for success in his work.

In dealing with vertical burners, the author states that candle power is measured horizontally at the middle height of the mantle; but, following with the inverted type, he leaves it open for the uninitiated to infer that horizontal measurement applies to all light sources so far as rating is concerned. The author remarks on the possibility of getting good equable illumination, without glare, by shaded or semi-indirect lighting; and this at no serious increase in cost.

In the lighting of shops, halls, workshops, and factories, stress is rightly laid on the fact that good sense and good taste, based upon science, have much to do with the production of a pleasing as well as an efficient job.

Mr. Webber's remarks are so good as to what to attempt and what to avoid in illumination that it is a pity he has not still further enlarged on the subject for the benefit of gas-fitters on whose work the interests of gas undertakings to some extent depend. The discussion of such subjects as the location of light sources for definite purposes—such as those which obtain in churches, schools, libraries, printing offices, and the like—would have been serviceable. It is not sufficient to give averages of foot-candle illumination usually employed, or to state vaguely that "the power of light-sources should be proportioned to their distance from the spectator or user."

Some pains have been taken to explain foot-candle illumination; and the data of illumination for specific purposes which is now available might with advantage have been included in the book. As to factory and workshop lighting, the author has reproduced extracts from his National Gas Exhibition lecture, and refers the reader for further information to the annual reports (1911 and 1912) of the Chief Factory Inspector. It would have been better to have abstracted the salient points of (say) the 1911 report, which contains valuable data on the subject. Incidentally it may be remarked that the author does not discuss the use of gas for ventilation; and there are therefore no examples of the sun-burners which can be employed for the purpose in halls and other large interiors.

Street lighting is only briefly touched upon. Here one notices the effect of London practice upon the author's observations. High pressure lamps only seem to be recommended for main street lighting, although there are many low-pressure high-power lamps up to 1000 and 1500 candle power units doing admirable service in provincial towns. The Westminster specification with street tests of lamps at 50 degree and 20 degree angles is given as an example of what is done—admittedly a good example where column spacing is not great. In the majority of cases outside London, however, the illumination is not so liberal, and 10 degree and 15 degree tests, even with 1000-candle power units, are probably the best guide to adequate lighting.

Before dealing with heating, cooking, and industrial work, Mr. Webber again renders good service by discussing the theory of the bunsen burner and the advantages of gas as a fuel. Those engaged in fitting work will do well to read these pages thoroughly, since they will get a clear idea of the calorific power of coal gas, and its utilization in the production of applied heat by means of fires and other apparatus.

Dealing with flueless gas heaters, the author refers to the Home Office instructions to factory inspectors, which precludes their use where the carbonic acid content of the atmosphere is likely to exceed 12 parts per 100,000; otherwise there is not any objection to what for certain conditions must be regarded as a serviceable method of heating. The author states that no harm to living beings has ever been proved by the discharge of combustion products into the air of an interior warmed or lighted by the free burning flames of gas.

Some 20 pages are devoted to cooking and hot-water apparatus. The suggestion that boiling burners fitted to cookers are not infrequently too large is followed by advice to the fitter to make any necessary adjustment by hammering over the injector tip, and then carefully broaching the orifice. Experience, however, indicates that it is risky to allow fitters generally to interfere with apparatus in this way; and if the makers have failed to supply what is wanted, none but skilled men should have permission to make the alteration.

The value of gas apparatus for the supply of hot water is discussed, and some useful illustrations included. The subject is not dealt with at any great length; but probably sufficient is said to help the gas-fitter on broad lines. No full particulars are given as to the sizes of circulating pipes or the radiators they could feed. Gas wash-boilers, so much in use in northern counties, are not referred to.

After a brief two-page reference to gas-engines, Mr. Webber concludes his book with some fair illustrations of London street lighting, and a handy glossary of technical terms.

It may be safely said that students, fitters, and others concerned with gas supply taken from the meter to the point of ignition will find the book generally useful, and well worthy of study.

COKE FOR STEAM-RAISING PURPOSES.

By a Gas Engineer.

APPENDIX I. TO ARTICLES IN VOL. CXXVII., PP. 664, 713, AND ANTE P. 24.

IT is of the greatest importance that manufacturers and owners of boiler plant who are using coke, in many cases for the first time, should be supplied with proper directions as to its employment. Such directions should be printed, preferably on stiff glazed cardboard, and should be supplied to coke users. In the first place, type-written directions can be sent to boiler users who have been induced to give a trial to coke; and in the event of its being regularly adopted, a printed board, suitably arranged for hanging up in a boiler-house, should be supplied. By this means each stoker will be able to read it at his leisure, and grasp more quickly the proper principles on which coke should be used.

It is suggested that the following would answer this purpose.

DIRECTIONS FOR USING COKE AS BOILER FUEL.

1.—Being a non-volatile fuel, coke must be fired on a different principle to bituminous coal.

2.—The fuel should be fired to maintain an even thickness from door to bridge.

3.—The thickness of the bed of fuel must depend on the size of coke, and should be approximately as follows:

When using large coke (say) 3 inch cubes, the fuel bed should be about 10 inches thick.
When using smaller coke (say) 2 inch cubes, the fuel bed should be about 8 inches thick.
When using broken coke (say) 1½ inch cubes, the fuel bed should be about 6 inches thick.
When using forge coke (say) ¾ inch cubes, the fuel bed should be about 4 inches thick.

4.—A coke fire of the right thickness, when burning freely and correctly, should have the appearance of being of a red and yellow colour on top. If much blue flame is visible, the thickness is too great; while if it is of a distinct yellow colour, the fire is too thin.

5.—All the air required for combustion should be admitted underneath and through the fire-bars. No air should be admitted through the doors, or through any smoke consuming appliance at the back of the bridge.

6.—Coke requires plenty of draught—more so than coal; so that it is advisable to make a special examination for air leaks between the brickwork and boiler at various points, through the damper opening, and through badly fitting portions of the fire doors. Any cracks in the brickwork should be filled in. An examination of this kind will frequently make all the difference between success and failure in burning coke.

7.—A coke fire does not require poking or stirring up. It should be left to burn without any attention of this kind; the only exception being that at intervals a slice should be passed between the fuel and the fire-bars, to break up clinker as it forms, so as to prevent it from adhering to the bars and from checking the admission of air.

8.—The tools in use should be kept properly sharpened. In burning coke this is of more importance than when burning coal.

9.—The intervals at which a coke fire should be cleaned will depend upon the ash in the particular coke that is being burnt and the rapidity with which the coke is consumed. This will vary widely—say, from 3 to 8 hours, according to circumstances.

10.—In cleaning a coke-fire the same method should be followed as when cleaning a coal fire; but it is of the greatest importance that as little as possible of good coke should be drawn out with the clinker and ashes. Unless great care is exercised, it will be found that after the fire is cleaned there is insufficient hot coke to ignite the fresh fuel. [This is a common fault with stokers who are inexperienced in coke stoking.]

11.—With a Lancashire boiler, when the load is on, a fair interval should be allowed between the cleaning times of the two furnaces, as it must be recognized that coke, like anthracite, being a non-volatile fuel, takes more time than bituminous coal to ignite and burn freely. With a Cornish boiler, when the load is on, it is advisable to clean at a time only one half of the furnace.

12.—It is unnecessary to use any coal at any time except when lighting-up a boiler from cold.

13.—Fires may be banked-up quite satisfactorily with coke.

Since the last meeting of the Barnet District Gas and Water Company, the Chairman, Mr. A. H. Baynes, has been removed by by death. He had occupied the position since the death of Mr. Charles Horsley, early in 1905; and he was also Chairman of the Harrow and Stanmore Gas Company. His will has lately been proved, and it shows that the value of his estate was £145,479. Mr. Baynes was a Justice of the Peace.

THE "CONDOR" GAS-FIRE.

Valentine's Patent.

THE Forth and Clyde and Sunnyside Iron Companies, Limited, of Falkirk, entered the arena as gas-fire makers two winters ago at the Glasgow Smoke Abatement Exhibition, with a new patent inset gas-fire called the "Ardor," the success of which was instantaneous. This was a natural result, seeing that the inventor, Mr. Henry S. Valentine, had the advantage of a unique training for the purpose. After a long and varied experience in the manufacture and sale of coal-grates, he had a term of service in the Glasgow Corporation Gas Department. In addition to a training in the science of gas at the Technical College of Glasgow, he worked with his own hands for the best part of a year on the perfecting of these gas-fires. Immediately after the Glasgow Exhibition, the firm showed at a similar exhibition in Edinburgh, held under the auspices of the Edinburgh and Leith Gas Commissioners, where the "Ardor" continued its triumphal progress. While the "Ardor" is regarded as an almost perfect example of what an inset fire should be, the inventor has added some refinements for those who are prepared to pay a little more money; and these are embodied in the "Condor" patent gas-fire.

Fig. 1 shows the "Condor" fire as supplied by the makers. It comprises a lower retaining front or fender, of polished cast iron, which is set down on the hearth in front of the grate in which the "Condor" is to be installed. The vertical fire bars have been previously removed from the existing coal-grate, while the bottom grating or grid of the coal-grate (which is usually a fixture) is allowed to remain. On this bottom grating the back portion of the gas-fire is made to rest by a pair of vertically adjustable legs or supports attached to the back casing of the "Condor" fire.

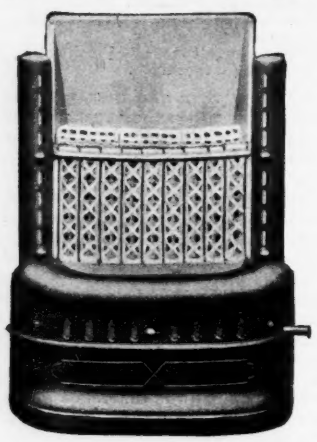
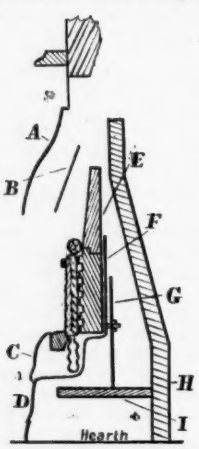


Fig. 1.—The "Condor" Inset Fire.

The back bricks of the gas-fire are then set in position; the top brick extending right up within the canopy of the existing coal-grate. Polished iron side panels, which are vertically adjustable, are now placed in position and securely fixed, so that their upper ends meet the wings, or sides, of the existing coal-grate canopy. The "fuels" are then set in position, the gas and air are adjusted, the top fret of the retaining front is screwed on.



A. Canopy of Existing Coal-Grate. B. Inner Canopy, when desired, fitted to the Vertically Adjustable Side Panels of the "Condor" Fire. C. Removable Fret of the "Condor" Fire. D. Polished Iron Retaining Front of the "Condor" Fire. E. Loose Top Brick of the "Condor" Fire. F. Iron Back Casing of the "Condor" Fire. G. Vertically Adjustable Legs of the "Condor" Fire. H. Back of the Existing Coal-Grate. I. Existing Grid.

Fig. 2.—Section of the "Condor" Fire.

The vertical sectional drawing given (fig. 2) illustrates clearly the position which the "Condor" fire occupies in relation to the existing coal-grate which it is intended to fill. It is immaterial whether the back of the grate is of the modern sloping brick type illustrated in fig. 2, or the old or modern vertical iron type.

Fig. 3 will give some idea of the complete transformation that is accomplished in a coal-grate of the well-known tile register type. It will be at once apparent that the whole of the fire-place which has been soiled by the previous use of coal as a heater has now been covered by the "Condor" gas-fire; while the distinctive feature of the coal-grate—viz., the canopy—has been retained to conduct the products of combustion to the chimney. This is done

Fig. 3.—The Complete Fire.

without the aid of a gas-fire canopy as used in the independent type of gas-fire, which, while it may be quite ornamental and pleasing when seen standing by itself in a show-room, is often not a success æsthetically when seen below the canopy of the existing coal-grate. The "Condor" fire is, of course, made in different widths to suit a large range of standard sizes of coal-grate.

DETERMINATION OF HYDROGEN SULPHIDE IN GAS.

AT the last Annual Meeting of the American Gas Institute, Mr. A. B. WAY, of Everett (Mass.), submitted, in the Chemical Section, a short paper in which he described a method for the determination of hydrogen sulphide in gas.

In introducing his subject, the author said there might be occasions, in large works, when the quantity of gas made would vary to a considerable extent from hour to hour, and as the proportion of sulphuretted hydrogen extracted from gas by a partially fouled purifier depends largely on the speed of the gas, it is a difficult matter to determine the relative efficiency of a number of boxes unless the samples of gas are taken simultaneously. To do this by the old methods, where the gas was passed through some absorbing agent and metered, would require a number of meters and absorbing trains. Besides, the cost of apparatus for (say) a dozen samples, and the setting-up and running of the twelve determinations at one time, would keep one man fairly busy for a while.

The apparatus consists principally of a wide-mouth bottle of about half-a-gallon capacity. The neck is fitted with a three-hole rubber stopper which is marked in any convenient way by which one may be sure of its being inserted in the neck of the bottle to exactly the same point each time. Two glass tubes project through the stopper to a distance of about 2 inches above and to an uneven distance below—one nearly to the bottom of the bottle, and the other only a short distance below the stopper. A thermometer is fitted into the third hole. Short stout rubber tubes with pinch-cocks are attached to the glass tubes. The bottle is calibrated at 60° Fahr., including the tubes up to the pinch-cocks.

The gas to be examined is passed through the dry bottle until all the air is expelled, and the stop-cocks are then closed—the outlet one first, which ensures a pressure in the bottle. The sample is brought to the laboratory and allowed to stand until its temperature approaches that of the room. One of the tubes is then connected with a longer rubber tube, the loose end of which is immersed in a beaker or other vessel holding exactly one-quarter of an inch of water. The pinch-cock on this tube is slowly released until the bubbles cease to rise through the water. The gas in the battle may then be considered as being at normal pressure, for that exerted by the quarter-inch seal amounts to only about 0·06 per cent. of the volume. The temperature is here noted.

After establishing normal pressure, the pinch-cock is closed, and the same tube is connected with a levelling-bottle. The other tube is connected with a large burette containing an ammoniacal cadmium chloride solution, consisting of 125 c.c. of water, 20 grammes of cadmium chloride, and 50 c.c. of strong

ammonia, filtered; 300 c.c. of strong ammonia, made up to 1 litre with water. By means of the levelling-bottle, a slight vacuum is produced in the sample bottle, and about 30 c.c. of the solution are allowed to run in. The pinch-cock is closed and the burette disconnected. The bottle is raised, and at the same time the pinch-cock is opened and the gas which has been drawn out is forced back into the bottle. The levelling-bottle is disconnected, and that containing the sample and cadmium chloride is shaken for a minute or two. Pressure is slowly released by opening the stopcock on the shorter tube, the stopper removed, and the contents of the bottle poured on to a dry filter.

The bottle is rinsed three times with a little water without attempting to clean out the particles of cadmium sulphide which stick to the bottle and tubes. The precipitate on the filter is washed twice with water, and the filter and precipitate are placed in the bottle. An excess of N/20 iodine solution, 3 c.c. of starch solution, about 200 c.c. of water, and 50 c.c. of commercial hydrochloric acid are added. The stopper is inserted, the pinch-cocks are closed, and the bottle is shaken for a minute or two. The stopper is again removed, the tubes rinsed into the bottle, and the excess iodine titrated with N/20 thiosulphate solution. By calculation from the calibration of the bottle and the absolute strength of the iodine solution, a factor is obtained which reads directly into grains of sulphuretted hydrogen per 100 cubic feet of gas per cubic centimetre of iodine solution. A correction is made for the temperature, and, if desired, for the pressure due to the quarter-inch seal. A blank is run every few days on the reagents employed, and the amount of iodine used in the blank is deducted from the iodine used in the determination.

The advantages of the method are that there is no action on the iodine by anything but sulphuretted hydrogen, as is the case when iodine is added directly to the gas; no meter is necessary, and the number of determinations that can be made simultaneously is limited only by the number of calibrated bottles at hand. The writer has taken twelve samples simultaneously from as many purifiers, and finished the determinations on the whole set, in less than two hours. Duplicate determinations which check within 0·5 per cent. are of daily occurrence.

The following is an example of the method of calculation: A N/20 solution of iodine contains 6·346 grammes of iodine per litre. From the reaction $H_2S + 2I = 2HI + S$, 1 gramme of iodine is equivalent to 0·13428 gramme of H_2S. Therefore 1 c.c. of N/20 iodine solution = 0·00085214 gramme, or 0·01315 grain, of H_2S. Then—

$$\frac{\text{C.c. in 100 cubic feet}}{\text{C.c. in bottle}} \times 0{\cdot}01315 =$$

grains of H_2S per 100 cubic feet per c.c. of N/20 iodine. Assuming, for instance, that the bottle holds 2000 c.c., we have—

$$\frac{2{,}831{,}677}{2000} \times 0{\cdot}01315 = 18{\cdot}618$$

or 1 c.c. iodine solution = 18·62 grains of H_2S per 100 cubic feet of gas.

FIRE-CLAY GOODS, AND THEIR USE IN GAS-WORKS.

By Thomas Holgate, F.C.S., M.Inst.C.E.

(*Concluded from p.* 600.)

The purification of clay as used by the potter ought to be a useful guide to the maker of gas retorts and bricks; and we may hope for an early extension in that direction. The recent researches of the ceramists into the frequency of magnetite in clay-wares ought also to be helpful, as the following brief statement will show. Dr. J. W. Mellor says that the oxides of iron, practically always present in pottery materials, are converted into magnetite, the stable oxide, during firing; and he has given a photomicrograph illustrating the formation of magnetite crystals. Free metallic iron is absent from normal pottery, and the magnetic qualities of clay-wares are due to magnetic oxide of iron, either free or dissolved in vitreous granules of ferrous silicate. Hopwood's supposition of a magnetic iron silicate he regards as unnecessary. These conclusions are valuable in relation to the extended investigation into "The Magnetic Materialsi n Clay-Wares" made by Mr. Arthur Hopwood, now to be summarized so far as they throw light upon gas-works practice. Where magnetite is stated by Dr. Mellor to be stable, we must doubtless understand this in relation to atmospheric influences—*e.g.*, the Barffing process for protecting iron surfaces—but not stable under the action of water gas or of brick-kiln gases or the furnace gases of water-gas or coal-gas plant.

Mr. Hopwood's classification of clay-wares is mainly by the colours of them; and in order to avoid repetition, the author adopts the divisions, class "A" for white, cream, grey, yellow, buff, red, or brown, and class "B" for flashed, brindled, or blue. Gas-works requirements come normally under class "A;" but it is necessary to refer also to class "B" to bring out the characteristics. Earlier investigators assumed that baked clays owe their magnetic properties entirely to the presence of magnetite, and that this is derived partly from the orientation of the magnetite originally present in the clays and partly from the reduction of the ferric oxide of the clays during the process of burning. This view was, however, found by Mr. Hopwood to be too limited, and class "A" are described as feebly or moderately magnetic, owing to the presence of black unfused grains of unchanged magnetic minerals and bluish-black fused globules of ferruginous silicates detailed in Table VII.; while class "B" are strongly magnetic, owing to the presence of ferruginous silicates and magnetic oxide of iron.

Class "A," when examined on a fractured surface, are found speckled with black unfused grains, or more frequently with bluish-black fused globules varying in size from minute bubbles to large blisters. The unfused black grains are generally unchanged granules or concretions of either magnetic or non-magnetic ferruginous minerals originally present in the unbaked clays. The more common bluish-black globules are never present in the unburnt clays, and are always attracted by a magnet. When heated to 1300° C. in a reducing, or to 1350° C. in an oxidizing, atmosphere, the fused globules melt, but otherwise undergo no change.

Table VII.—*Analyses of the Magnetic Globules in Clay-Wares, shown to be Complex Ferruginous Silicates.*

Component.	From Salt Glazed Pipes. (Burslem).	From Red Bricks. (Hanley).	From Blue Bricks. (Tunstall).	Average of the Three Sources.
Silica	40·52	42·03	42·83	41·79
Alumina	17·85	16·50	15·50	16·62
Ferrous oxide calculated from total iron	30·73	31·65	34·27	32·22
Manganous oxide	0·92	0·74	0·83	0·83
Lime	4·33	4·55	2·74	3·87
Magnesia	4·82	3·53	2·93	3·76
Alkalies	0·58	0·90	0·72	0·73
Total	99·75	99·90	99·82	99·82

When class "A" wares have been flashed—*i.e.*, partly reduced in the baking process, so that their surfaces become greenish-black or bluish-black in places—they invariably contain more fused globules of ferruginous silicates than those normally fired, together with varying amounts of an unfused magnetic material present in the patches. On analysis, a greenish-black patch on a piece slightly flashed gave 2·1 per cent. FeO and 6·5 per cent. Fe_2O_3, indicating that only part of the Fe_2O_3 was reduced to Fe_3O_4; while a bluish-black patch on a badly flashed brick made from the same clay gave 2·8 per cent. FeO and 5·7 per cent. Fe_2O_3, corresponding to the proportions of these oxides to be found in magnetic oxide (Fe_3O_4).

Mr. Hopwood removed from six different clays the granular and concretionary ferruginous minerals, by passing them through a fine sieve and subjecting them to an electro-magnet. When the purified clays were heated in the slightly-reducing parts of certain kilns, or, better, when heated to 1300° C. in the strongly reducing atmosphere of another kiln, they yielded white, grey, or blue magnetic bodies containing unfused magnetic oxide, but free from fused globules of ferruginous silicates; while the unpurified clays yielded bodies containing both. When clay-wares have speckled bodies, flashed surfaces, or black cores, they are always much more magnetic than the corresponding ones free, or relatively free, from these defects.

The practical man will find in this research by Mr. Hopwood much that will help him, and possibly the most important will be the fact, as shown in Table VII., that from three different sources were obtained ferruginous silicates differing but slightly in composition. The writer, besides computing the last column of the table, has computed the molecular proportions of the components, and these coincide very nearly with one molecule of silica to one molecular equivalent of the remaining components. It will be noted that the content of ferrous oxide in the analyses is calculated from the total iron; but if some of this be actually present as Fe_2O_3 or, what in this particular means the same thing, Fe_3O_4, the equivalence of one molecule of acid (SiO_2) to one molecule of bases is reached. Whether such a simple relation will be discovered in the fusible constituent found in other clays only further experiment can decide; but it is worthy of note that this one has a normal melting point of 1350° C.—the same temperature that we saw in the earlier parts of this article to be so important in the case of the British and American fire-bricks tested under pressure. This is also the temperature found by Hilpert to be the one under which ferric oxide begins to lose oxygen when heated in air. A series of coincidences doubtless more than merely fortuitous.

The writer has on a previous occasion adduced examples of fire-bricks that possessed black cores, and that under the conditions of water-gas plant failed most signally; and the investigation of Mr. Hopwood appears to give a good reason why they did so. To remedy such defects the removal of iron from clay is an essential; and the possibility of its partial, if not complete, fulfilment appears now to be within reach. In this article, mention has been made of bricks known to be refractory, and yet having upon them large numbers of unfused black specks. The explanation of this anomaly would appear to be furnished by the purified clay results of Mr. Hopwood, which, as stated above, yielded only unfused magnetic oxide—being free from the ferruginous silicate to which the writer has just referred.

The evidence marshalled in these articles appears to show that Great Britain possesses many clays that are of a high order of excellence, and that those which are not naturally so may be very much improved by the application of scientific methods to the manufacture and subsequent use of fire-clay goods.

TRANSLUCENT MARBLE FOR LAMPS.

In the "JOURNAL" for the 28th of April (p. 262) there appeared, under the above heading, a brief account of some experiments carried out by Herr Voege, and described in the "Elektrotechnische Zeitschrift," on a method devised by Herr W. Engel, of Hamburg, of polishing and impregnating marble, by which great transparency is imparted to it, so that it can be employed in substitution for opaline glass for lamps. In view of the great interest the subject has aroused, we give, from a recent number of "L'Elettricistà," the following abstract translation of Herr Voege's article.

The properties of the marble in question, through which no white light passes, were compared with those of opaline and ground glass usually employed in connection with illumination. The study therefore deals with the transparency of marble to (1) visible rays, (2) ultra-violet rays, (3) infra-red rays. At the same time its power of diffusion is determined, and compared with that of opaline glass. Finally, in a practical test, opaline glass was replaced by marble, and the illumination produced in each case was measured; the superiority of marble being thus established.

TRANSPARENCY AND DIFFUSION OF MARBLE WITH VISIBLE RAYS.

The two samples tested were 3·5 mm. thick, and were transparent on the front (turned towards the incident light) and opaque on the back. The opaline glass for comparison was opaque on both sides—1·8 mm. thick, clear opaline, and 3 mm. thick, dark opaline. In some cases ground glass 3 mm. thick was used; also streaked glass 5 mm. thick. The incandescent filament of a lamp placed before the marble and opaline screens was not visible; it was, however, quite distinguishable with ground glass.

In the first experiment (the distance between the source of light and the photometer being kept constant) the following results were obtained:—

Without screen	(220 lux)	100·0
Marble ,,	(51 ,,)	23·2
Clear opaline screen	(42 ,,)	19·1
Dark ,, ,,	(31 ,,)	14·1
Ground glass ,,	(148 ,,)	67·4

Another experiment gave the following results (the transparency of marble being taken as 100): 81·85 and 300. This confirms the superiority of marble as compared with opaline glass. Moreover, the marble screens are regularly illuminated as far as the edges; and, compared with opaline glass, they give the impression of pure white.

The relative transparency in red, green, and blue, taking that of clear opaline glass as being equal to 100, is as follows:

	Red. 700 and 610 $m\mu$.	Green. 580 and 550 $m\mu$.	Blue. 435 $m\mu$.
Marble	111	100	141
Clear opaline	100	100	100
Dark ,,	89	100	106

The prepared marble thus also absorbs green-yellow; and this explains its violet-red tint.

The efficiency of diffusion of prepared marble is particularly good under the following conditions: An ordinary incandescent lamp—*e.g.*, of tantalum—was enclosed in a funnel-shaped box with reflecting sides. The front part of the box was successively closed with a marble screen and then with opaline glass; and the efficiency attained was 80 and 60 per cent.

It was interesting to ascertain whether this great transparency of marble is not obtained at the cost of its diffusive power. With this object a Nernst lamp was placed upon the axis and 20 cm. distant from an opening made in a large black screen. Then the three plates of marble and clear and dark opaline glass were successively applied to the opening. The radiating intensities were measured 10° on all sides of the vertical, up to 90°, and the indices of diffusion were calculated for transmission of the three substances. The resulting diagrams demonstrate above all that the true and theoretic curves are much the same, and also that the marble, in spite of its great transparency, is not inferior to opaline glass from the point of view of dispersion.

In another series of experiments, sheets of marble and opaline glass, 40 cm. square, were illuminated with a tantalum lamp of 25-candle power placed at 10 cm. on the vertical in the centre of the screens, and with a large black square surface behind. The illumination given from an area of 6 square metres was then measured, applying the blackened tube of the photometer directly to the marble and glass. The photometer screen was then at a distance of 7 cm. from the illuminating surface. The next table summarizes the results obtained. The last two columns show clearly the effect on the permeability of the marble by the Engel method of preparing it. Measuring the total radiation 2·4 metres distant, the figures at the bottom of the corresponding columns were obtained, in percentages of incident light, for each kind of screen. The thickness of the screens was such that the incandescent filament placed almost in contact was not distinguishable.

Finally, a practical test was made by Herr Voege in his own laboratory, normally illuminated by three 40·7-watt tantalum lamps of 25-candle power, with clear bulbs, and six other lamps, of 44 watts, with ground glass. After careful and repeated experiments, he was able to note that marble is not inferior to any other substance, either from the point of view of economy or the distribution of light. Marble is to be preferred on account of the softness of the light transmitted.

Point Examined.	Opaline Glass.	Marble not Impregnated. One Clear Side.	Marble not Impregnated. Two Clear Sides.	Marble Impregnated. One Clear Side.	Marble Impregnated. Two Clear Sides.
	Lux.	Lux.	Lux.	Lux.	Lux.
Centre of plate	11·0	17·4	20·7	25·4	28·0
4 cm. from centre	8·7	14·0	19·4	24·0	27·0
8 ,, ,, ,,	6·2	9·2	12·0	16·0	18·8
12 ,, ,, ,,	3·5	5·5	7·5	11·8	13·0
16 ,, ,, ,,	1·7	3·2	4·1	8·5	9·7
Efficiency	17·0	23·5	29·0	35·5	39·4

TRANSPARENCY OF MARBLE TO ULTRA-VIOLET RAYS.

It was experimentally demonstrated that there is no difference between the transparency of marble to visible rays and invisible or ultra-violet rays. The method of making this observation consisted in filtering the visible light of a mercury lamp with quartz bulb through a dark blue *uviol* glass and a copper sulphate solution 1 cm. thick. The ultra-violet rays alone passed through this combination, and they fell upon a photo-electric cell with a potassium cathode, prepared according to the method of Elster and Geitel, and connected with a galvanometer. The results obtained were as follows, taking in each case the transparency of marble as 100: Clear opaline glass, 64·7; dark opaline, 58; and for the first visible light, clear opaline glass, 81; dark opaline, 56. The results, however, give no idea of the pleasing impression produced by light from marble.

TRANSPARENCY OF MARBLE TO INFRA-RED RAYS.

Very different results are obtained if, instead of measuring the illumination, the rays emitted by a carbon filament lamp are concentrated on a thermo-electric couple in a vacuum. The radiations passing through marble are those which give the least deviation, as demonstrated by the following figures:

Radiating Source.	Deviation of Galvanometer. Divisions.	Transparency to Visible Rays.
Carbon filament lamp	2200 .. 6900	223
Clear opaline	200 .. 650	81
Dark	115 .. 366	56
Marble plate	32 .. 100	100

Thus marble, more transparent than opaline glass for the visible part of the spectrum, gives passage to from three to six times less energy than glass; and as these visible rays enter to a very slight extent into the total irradiated energy, the conclusion is that marble is impermeable to the infra-red rays—*i.e.*, those not found in diffused daylight. It is owing to the absence of these rays that the light from marble is so pleasing to the eye.

Herr Voege also examined other substances. Water, for example, which absorbs calorific rays well, is nevertheless inferior to marble. The latter, with a thickness of only 3 mm., scarcely gives a deviation of 32 divisions, while 1 cm. of water gives 266 divisions. For technical applications, marble can hold the first place. Its superiority is not only due to the nature of the light it transmits, but above all to the absorption of calorific rays.

CONCLUSIONS.

The conclusions arrived at are as follows: (1) Marble has a transparency and power of diffusion with light greater than those of all the opaline glass tested. (2) It gives a white light most pleasing to the eye, and prevents all glare. (3) It absorbs the infra-red calorific rays, though remaining most permeable to light, to a degree hitherto unknown.

Injection of Chemicals for Water Filtration.—In purifying water drawn from rivers, it has in many cases been found impossible to obtain a clear filtrate after treatment with sand, and it has been necessary to employ some form of coagulant, such as aluminium sulphate or alumino-ferric, to complete the operation. The problem of adding the chemical is of some importance, since, if too little is used the water is not properly clarified, and if too much, not only may there be serious waste, but corrosion of the mains, and even injury to the health of the population depending on the water supply, may result. As in practically all cases the rate at which water is delivered to the mains will vary greatly over the 24 hours of any day, it is clear that the rate of supply of the chemical must be correspondingly varied, and, to ensure the best results, it must be added as a constant proportion of the water used. Some time ago, the Hon. R. C. Parsons was consulted by the Directors of the Water-Works Company of Rosario in connection with this matter; and he designed an apparatus for automatically adding the chemical in absolutely direct proportion to the flow of water. It was known as the "Tiltometer," and it was found generally to work satisfactorily, but not in the case of plant employing mechanical filters where the salt had to be added to water flowing in mains under pressure. Mr. Parsons has accordingly devised another apparatus, termed the "Senfrot," which is described and illustrated in "Engineering" for the 11th inst., in which publication a description of his original appliance appeared some time ago.

GAS-HEATED HOT-WATER APPARATUS.

By T. F. C. Potterton.

[A Paper read before the London and Southern District Junior Gas Association, Dec. 11.]

The general recognition of the numerous advantages—or, one may almost say, the necessity—of hot-water apparatus under modern conditions of life, both for warming and domestic uses, has created a good field for a special branch in the building industry; and from the gas engineers' standpoint this has been an important development, bringing into existence an additional outlet for the use of gas. This, it is generally agreed, is furnishing one of the means of progress necessary for the healthy condition of commercial undertakings engaged in the manufacture and distribution of gas, and is worthy of the careful attention of all concerned. Gas water-heaters are being most commonly applied to hot-water service for domestic purposes, where the intermittent demands, and the economical effect of the thermostat, render them invaluable in the smaller class of house and flat, in which the difficulties of the kitchen range and the servant question are most acutely felt. Moreover, many instances occur where they can be applied with advantage for warming with radiators to meet special cases, though it is necessary to admit that the running cost does not bear favourable comparison with that of coke or other forms of solid fuel occurring in hot water supply work, mainly on account of the advantage afforded by the thermostat in so accurately regulating the hot-water supply in accordance with the demand. In this paper, apart from reference to two special forms of domestic supply apparatus, I propose to deal with the subject of warming, and have collected various data of ordinary and irregular systems which I hope will bring out some interesting features.

Some Special Forms of Domestic Supply Apparatus.

Fig. 1 is an example of treatment in a small tenement or flat, where a suitable cold-water cistern is not available. In such

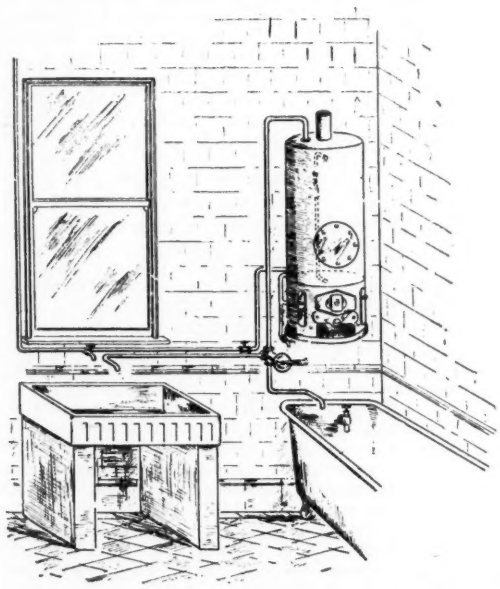


Fig. 1.—Installation for a Small Tenement or Flat.

cases, while the fixing of one with the accessory cold feed and expansion piping might not be out of the question from the point of expense, difficulty often occurs in obtaining sufficient head of pressure to give a reasonable outflow at the taps. With the arrangement shown, however, the cold-water feed to the cylinder is branched-off the existing cold service, whether it be from the main or an existing roof cistern, and is controlled in the manner indicated; while from the top of the cylinder, in place of the ordinary expansion, a pipe is carried to a special form of three-way valve, having two outlets with supplies delivering hot water to the requisite points, one of which is always open, thereby allowing for the expansion of the water in heating-up. In drawing hot water at either point, the lever of the three-way valve is turned to the point requiring the supply, and the cock in the cold feed opened. In some districts, it may be possible that this arrangement is at variance with the bye-laws of the water authorities; but this can only be a technical point, as it is the most economical form of installation where the supplies are limited to the requirements shown. The foregoing is one of the most simple forms of apparatus, being self-contained in its boiler and storage, without the need of secondary circulation, and is thus suitable for working independently of the kitchen-range.

The other example of gas apparatus as applied to domestic hot-water service is an installation in a larger house, where the boilers are used as an auxiliary to the range. This is an instance where there is a considerable distribution of points for hot-water supply; the secondary flow and return extending the entire length of the building, in order to deliver hot water in circulation close to the bathrooms of the various bedroom suites, and feed the hot-water towel-rails provided in them. For such purposes the use of gas-heaters exclusively is likely to be too expensive; but as an adjunct to the kitchener, they prove a very satisfactory solution of a common difficulty. It is principally in the early morning that the supply from a kitchen-range is inadequate; and the assistance of gas-boilers successfully overcomes this deficiency. In summer time the boilers will doubtless answer for the entire hot-water service; and, if supplemented by a gas-cooker, the kitchen-range need not be used in very hot weather. At such times the long secondary flow and return would usually be non-circulating, by shutting the control-valve, as the heating of towel-rails, &c., is unnecessary.

The control-valve referred to is in this case placed in the entrance hall cloak-room instead of in the kitchen, so that a portion of the secondary circuit can be in action serving the occupier's bathroom and vestibule lavatory, and the remainder cut off, as for the greater portion of the year the supply in the extra bathrooms can be dispensed with. To allow of this a ¾-inch bye-pass is formed between the secondary flow and return, at a point adjacent to the branch for the vestibule lavatory. This permits the circulating water to return from this point and maintain the heat of the towel-rail and quick delivery of hot water in the best bedroom suite and domestic offices.

A feature to observe in arranging systems of this character lies in the pipe sizing of the cold feed and secondary flow. In this case they are 2 inches and 1½ inches barrel respectively, in order to maintain the water-level in the secondary flow-pipe and fittings. If these were not adequately fed, it would cause some of the non-circulating cold water to mix with the hot water, when the discharge from the taps overlaps the feed water to the storage cylinder. Under such circumstances, the supply would be affected by the cold water contained when the night valve is in use, and rendered more or less unsatisfactory; and air would collect in the towel-rails and the upper branches of the apparatus—a condition that is always undesirable.

Apart from the special features referred to, this installation is designed upon standard practice; the gas-boilers being connected independently of the kitchen-range with the main flow taken to the top of the cylinder, and the return from two connections at the side; the lower connection having the cut-out valve, reducing the reserve of hot water to about 15 to 20 gallons, which is usually found to be sufficient for general household purposes, except when baths are required.

Gas-Heated Water for Radiators.

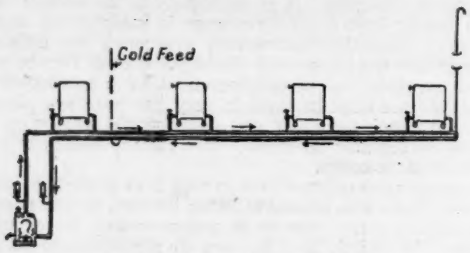
Leaving the subject of hot water supply with these two examples I would ask you to refer to the five diagrams of radiator systems illustrated in fig. 2 (p. 664), which represent the ordinary systems of "natural circulation" most commonly used. In these the piping must be laid with a continuous gradient from the boiler to the end of the system, or wherever the highest point occurs; and under such conditions the movement of the water (or, in other words, the "circulation") commences immediately the temperature of the water is raised in the boiler, causing a difference in the density or weight of the flow and return. It is doubtless common knowledge that this is the motive power of all gravity systems of hot-water circulation; but, to overcome various conditions or difficulties that may occur in the position of the heating chamber, the passing of doorways, &c., whereby the application of one of the ordinary systems illustrated would be impeded, various forms of "irregular" apparatus are now being put forward, to which I shall refer later. These are frequently termed "accelerated" systems; and in this respect they differ from the "natural" circulating apparatus, as the description implies.

The five diagrams illustrated vary principally in two respects—viz., in regard to "one-pipe" and "two-pipe" construction. The first example shows the former, in which the radiators are connected in both flow and return branches to the flow-pipe of the main circuit, which has therefore to be of the full bore for its entire length. This is a useful system where the number of radiators is limited to three or four (in gas heating), or where in large installations the radiators are divided into two or more sets on separate branches. But in all cases the partly cooled water is carried past the succeeding radiator, with the natural tendency for the last to suffer in temperature, unless the main is over-size with boiler power proportionate. In spite of this drawback, the arrangement has been adopted very considerably in coal and coke-fired apparatus; and as far back as 1896 Mr. Thomas Potterton published a book dealing with the warming of houses on this principle and circulating below the boiler. But, having regard to the conditions described, I consider that the two-pipe system is preferable for general use.

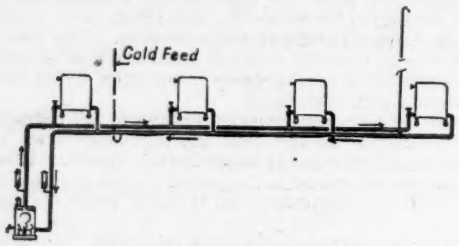
Taking the second example as the most usual form of the two-pipe system, it will be noticed that the outlet from each radiator is connected into the main return, causing the water thus cooled to be carried back to the boiler and re-heated without affecting any other part of the system. This form of return connection also enables the piping to be reduced in bore according to the heating surface of the respective radiators, which therefore tends to economy in initial cost of installation, besides limiting the size of the main to be heated, which is of much advantage in fuel consumption.

Examples Nos. 3 and 4 are variations of the two-pipe system, carrying the main to a central point, and thence dividing the work

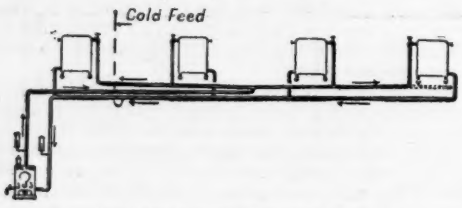
into halves or equal portions, which is commendable when the disposition of the radiators permits it. In the case of the fourth example, the radiators are assumed to be on two floors; and in connecting the lower pair the branches are taken from the main below, forming as much vertical rise as possible to the radiators, to induce circulation as equally as practicable.



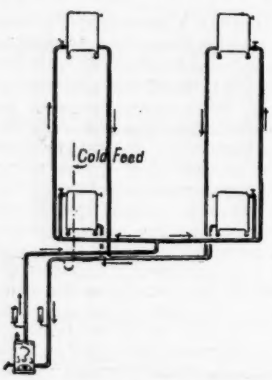
One-Pipe System—Example No. 1.



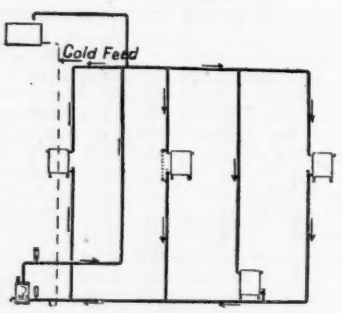
One-Pipe System—Example No. 2.



One-Pipe System—Example No. 3.



Two-Pipe System—Example No. 4.



Overhead System—Example No. 5.

Fig. 2.—Examples of Natural Circulation Systems.

Example No. 5 depicts an instance where the boiler happens to be on the same level as the radiators, in which case it is not possible to carry the mains on the "direct" principle previously described. The main flow for this purpose is therefore taken with a continuous rise to a point above the top radiators, with an open air-pipe at the highest point, diverting into separate branches and serving the radiators on drop mains, as nearly as possible equivalent in total bore to the main flow; thence returning horizontally at the boiler level. This is a very effective form of apparatus, as the vertical height is favourable to quick circulation, and enables the use of smaller piping than in the case of the horizontal systems shown.

Valves are usually provided to all radiators; and where this is so, it is necessary in designing a two-pipe system to form a ¾ or 1 inch connection between the flow and return of one of the remote radiators, on account of the possibility of all of them being shut-off. Should this happen, however, and the boiler be in action, a complete circuit is thus maintained and trouble avoided. It is advantageous also to fit hot-water thermometers in the flow and return near the boiler, where the expenditure permits, as heating apparatus of this nature having to be operated by hand the temperature of the water is a safe guide to the regulation of the gas-burner.

Fig. 3 is the working diagram of an overhead system just completed at Sutton for the Prudential Assurance Company, and, with the test, may be useful as an authentic example of this form of circulation. In this case, the remote radiator is not fitted with a valve for control, thus making it unnecessary to provide the loop or bye-pass in the flow and return of one of them, as the complete circuit is always maintained by the radiator.

At the time the test was made (Nov. 18 last), this floor of the building was open at the front and side; and owing to the low temperature of the air, the results are considerably lower than will be the case during ordinary use. The temperature of the atmosphere during the test was 36°, with a cold wind. The water temperature was 40° Fahr.

Time.	Thermometer "A" Deg. Fahr.	Thermometer "B" Deg. Fahr.	Gas Cub. Ft.	
2. 0 p.m.	40°	40°	—	
2.30	106	99	80	
3. 0	120	110	160	
3.30	147	128	240	
4. 0	160	136	320	One boiler turned out at 4 p.m., reducing consumption of gas to 80 feet per hour.
4.30	158	130	360	
5. 0	150	120	400	

There are 270 superficial feet heating surface in the apparatus, and two No. 20 "Victor" gas-boilers, to consume 80 cubic feet per hour each, are provided, in order that the heat may be obtainable quickly in the morning, though in daily use one boiler only will do all that is required after the first hour. This will be regulated at the gas-tap according to the outside conditions; the temperature of the remote thermometer in the general office indicating what is necessary in this respect. It will be seen from the foregoing that, under average conditions, 1 cubic foot of gas is capable of maintaining a satisfactory temperature for one hour in 3 feet superficial of heating surface.

Motor-House Heating.

Heating apparatus of the varieties thus described can only be applied where the boiler is situated at the level of the lowest radiator or entirely below same; but instances are met—such as in the case of motor-houses, flats, &c.—where it is not possible to adopt any of the examples cited, and particulars of treatment for such requirements may be useful.

Take the case of motor-house heating, where the boiler, though standing at the same level, cannot be connected to the radiator with an overhead circulation having a low return (as example No. 5, fig. 2), on account of crossing the doorway or the alternative necessity of cutting up the floor. It is permissible in simple cases of this nature to depart from the standard practice and carry the return above the doorway, following the flow-pipe, taking the precaution of arranging a continuous gradient and fixing an open air-pipe at the highest point of each, in order that the apparatus may fill up without air-locking.

Fig. 4 illustrates a system designed in this way; and the following are particulars of a test recently taken, showing by the thermometers the progress of heating. In the apparatus there is altogether 45 square feet of radiating surface; and the gas consumption was set at 26 cubic feet per hour.

	Thermometers.					
Gas lighted—	A.	B.	C.	D.	E.	F.
10.40	58°					
55	110	89°				
11.10	123	119	100°	72°	63°	
25	136	127	110	100	93	87°
40	149	140	120	110	105	99
55	160	150	130	123	114	108
12.10	167	159	140	134	123	117

This shows the very even results and free circulation throughout the system; the mean temperature in the radiator (shown by the flow and return thermometers B E) gradually increasing to 141° Fahr., though the rate of circulation is somewhat slow, owing to the lift necessary in the high return. This, however, does not appear to affect the general efficiency, as the returning water, though lower in temperature, is raised to a higher degree of heat in passing through the boiler at a slower rate of circulation.

As regards the heat maintenance, having now reached a satisfactory temperature in the system, the gas could be reduced to a lower consumption, according to external conditions—a subject which is dealt with later.

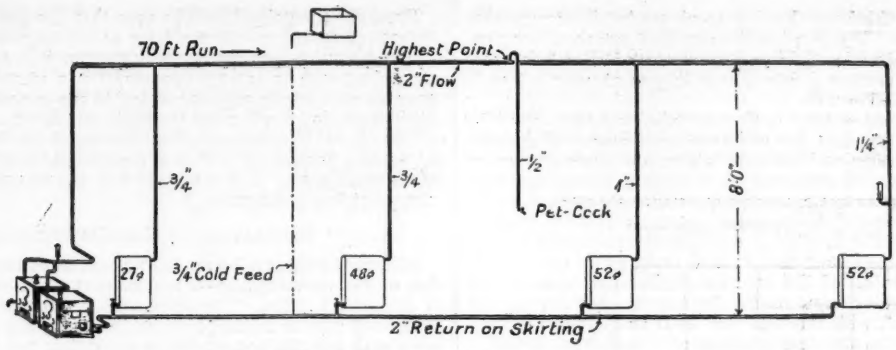


Fig. 3.—An Overhead System for Radiators at Sutton.

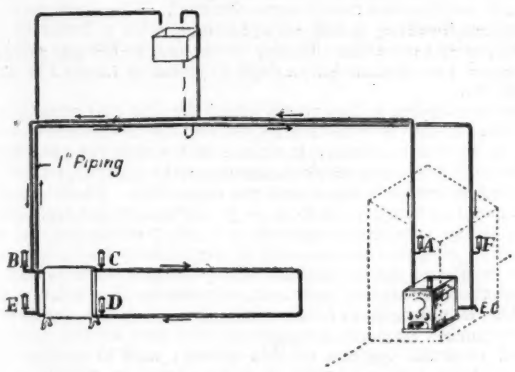


Fig. 4.—Installation for a Motor-House.

Heating a Bungalow, Flat, or Offices.

Another example of a larger installation of a similar kind is an irregular system applied to a bungalow, flat, or suite of offices, where the circulation has to be confined to the single floor. In this case there is a high return rising over three doorways; and being constructed with a single circuit on the one-pipe system, in regard to the method of connecting the radiators, there are four high points at which open air-pipes are fitted, in addition to the usual air-vents on the radiators. The following are the results of a test carried out with this apparatus; the gas consumption being at the rate of 62 cubic feet per hour, with water at an initial temperature of 46°.

Thermometer Readings.

	Flow Pipe Near Boiler.	Flow of No. 1 Rad.	Top of No. 1.	Flow of No. 2.	Top of No. 2.	Flow of No. 3.	Return of No. 3.
Temperatures in—							
One hour .	204°	184°	115°	145°	115°	100°	74°
Two hours .	205	192	137	168	145	142	112
Three hours .	205	192	141	180	160	163	134
Four hours .	206	194	141	180	163	163	136

This demonstrates the action of the one-pipe system referred to in connection with example No. 1, fig. 2, showing the cooling effect on successive radiators; the final temperatures reached during the test being as follows: Radiator No. 1, 194°; radiator No. 2, 180°; radiator No. 3, 163°.

It is, however, a very safe principle to adopt in this class of work; for with two-pipe connections to an overhead main, there would be a probability of short-circuiting in some branches and of the consequent missing of other radiators, and, since by the regulation of the valves a uniform heat can be obtained in all the radiators, the point of objection referred to can be overcome.

Boilers above the Radiators.

The two examples of irregular apparatus last referred to deal with heating apparatus where the boiler is fixed at the level of the radiators; but instances are sometimes met where it is desired to fix the boiler above the floors to be heated. To arrange a low-pressure apparatus of this kind is adverse to theoretical ideas of gravity circulation, though at a certain extra expense in fuel it is possible to operate heating systems so arranged, as fig. 5, with particulars of tests quoted, will show.

In the left-hand sketch a No. 19 "Victor" gas-boiler is fixed on the second storey, from which it is proposed to heat a radiator on the ground floor; while in the other illustration a No. 19 "Victor" boiler is introduced at the bottom of the apparatus at ground-floor level, showing in comparison the difference in the heating and movement of the water in each case.

In construction, the special apparatus is arranged upon the lines of the overhead system, in order to create a rising column of heated water, thus inducing circulation by means of the temperature difference, and consequently the difference in the weight of the waters, in the rising and falling pipes. At the head of the circuit, in place of the ordinary expansion-pipe, a small closed vessel or tank is fitted, having water, in the particular design

An Irregular and a Regular System.

Irregular System.

		A.	B.	C.	D.
Gas lighted . .	8.45	60°	Consumption 60 ft. per hour.		
	50	70			
	55	98			
	9. 0	124	65		
	5	137	80	70°	62°
	10	178	108	95	74
	15	188/200	124	120	86
	20	190/200	138	123	114
	25	Gas reduced to 30 ft. per hour.			
	30	198	150	138	136
	35	Gas reduced to 20 ft. per hour.			
	40	168	139	137	132
	55	180	137	134	133
	10. 0	184	137	134	132
	10	176	136	130	128
	20	190	136	130	128
	50	Gas reduced to 10 ft. per hour.			
	11. 5	168	113	110	100
	20	170	110	104	94
	35	168	108	100	90
	50	162	104	98	86

Regular System.

		C.	D.	A.	B.
Gas lighted . .	8.45	57°	Consumption 60 ft. per hour.		
	50	65			
	55	107	92°	80°	58°
	9. 0	112	100	96	80
	5	126	110	106	92
	10	134	120	110	102
	15	145	128	125	112
	20	152	138	134	120
	25	Gas reduced to 30 ft. per hour.			
	30	165	150	147	137
	35	Gas reduced to 20 ft. per hour.			
	40	166	152	149	142
	55	163	151	147	142
	10. 0	162	150	146	141
	10	162	150	146	140
	20	161	150	146	140
	50	Gas reduced to 10 ft. per hour.			
	11. 5	147	142	139	131
	20	142	138	132	127
	35	137	133	127	122
	50	135	131	125	120

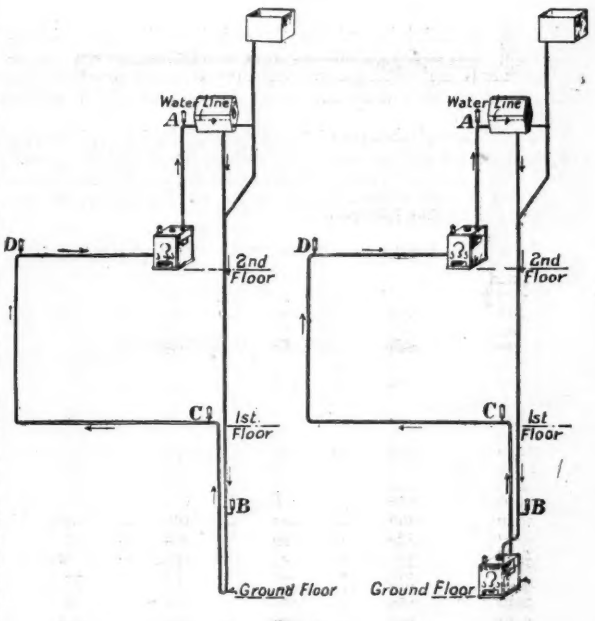


Fig. 5.

shown, about one-third up—leaving an air-pocket in the remaining portion above. The usual cold-water feed cistern and expansion-tank are required; and this can be connected directly into the sealed tank, or (as shown) into the falling main, with a ¼-inch branch to the sealed vessel.

Analyzing the temperatures in the two tabulated tests, it will be found that the outstanding feature lies in the difference of the heat produced by the boiler, and the result obtained at the point where the radiating surface is presumed to be fitted. Taking the fifth reading (9.5 a.m.) as an example, a temperature of 137° is obtained in the rising flow-pipe of the irregular system at A, while the heat at B (the position of the radiator) stands at 80° only, with a final drop in the complete circuit to 62° (total drop, 75°). Comparing this with the equivalent of the right-hand tabulation (quoting the test with the "regular" apparatus), the temperature leaving the boiler (at C) is 126°, with 110° and 106° at D and A respectively, and a final drop in the complete circuit to 92° (total drop, 34° only). The same conditions occur all through the tests, the flow-pipe reading of the left-hand example having to reach the boiling-point intermittently in producing the temperature of 150° at C; and having regard to the disadvantage of working at high temperatures, the adoption of irregular systems of this extreme character is not advocated.

Tank Heating.

Before leaving the subject of irregular systems, an instance of heating the contents of an open tank may be a useful adjunct to the paper. Fig. 6 shows an apparatus erected to obtain information for the late Mr. A. W. Onslow regarding heat maintenance in an open tank holding acids in connection with electro-plating

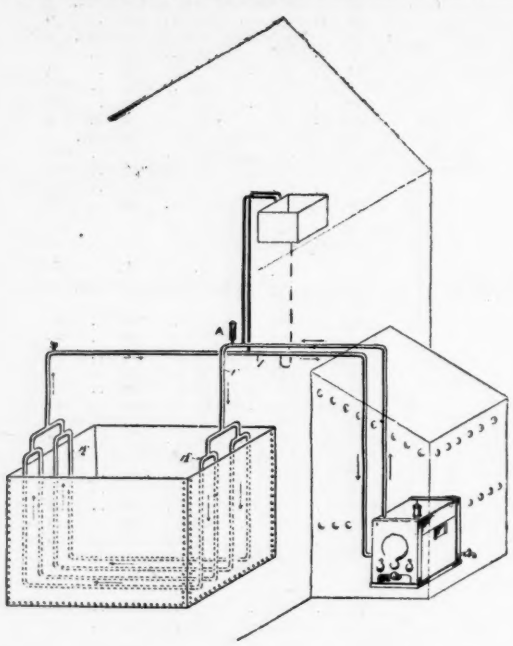


Fig. 6.

work. In the test taken at the Cavendish works, the tank was filled with water and a galvanized iron vessel used, though a lead-lined tank and lead piping are necessary in actual practice with acids, as galvanizing does not stand the solvent action of the chemicals used.

A temperature of about 100° was required; and a tank having a capacity of 230 gallons was fitted with 40 lineal feet of 1¼-inch piping, with a No. 20 "Victor" boiler and 1 inch overhead circulation, having a high return, similar to fig. 2. Particulars of two days' test resulted as follows:—

	Flow "A."	Return "B."	Tank.	Gas Consumption Cub. Ft. per Hour.
Gas lighted—				
4.15 p.m.	47°	47°	47	—
5.15	191	70	57	80
6.15	197	78	68	80
7.15	200	85	78	81
8.15	203	95	88	82
9.15	204	104	98	81
Next Morning—				
9.30 a.m.	—	—	68	—
10.30	200	83	75	81
11.30	204	90	86	80
12.30 p.m.	205	100	95	80
1.30	206	105	101	40
2.30	167	102	104	44
3.30	140	101	103	24
4.30	135	99	102	17
5.30	136	98	100	18¾
6.30	148	98	98	24
7.30	170	102	102	55
8.30	162	102	102	30
9.30	146	100	102	25½
10. 0	146	99	101	12

From the foregoing it will be seen that the gas was burning at the rate of 80 cubic feet per hour at the start, in order to reach the temperature required as quickly as possible, after which it was maintained with an average consumption of 25 cubic feet per hour. It would necessarily vary according to the external temperature; but in everyday use it could be easily regulated.

This also affords an example of the use of gas for indirect heating for any purpose of a similar nature that may occur—such as bottle rinsing, &c. It is a system that can be relied upon to act with precision and accuracy.

Regulation of Gas Consumption.

Reference may next be made to a special feature in the regulation of gas consumption—a requirement which may often occur in domestic heating. The apparatus in question contained 120 superficial feet of heating surface, including the mains, and was fitted with a boiler consuming 30 cubic feet per hour maximum. The connections to the two sections were formerly arranged with ordinary tee branches; and with either half of the system in use generally satisfactory results were obtained. The working of the apparatus, however, under all conditions, with a boiler of full capacity would occasion difficulty in regulating the gas supply; and in order to obviate this, a duplex system of valves has been introduced.

The new boiler, a No. 19 "Victor," having two connections available for both flow and return, enabled the circulation to each point to be run separately, in unison with which the gas supply was branched into two services, and stopcocks having interlocking levers fitted for both water and gas regulation. There are also cocks in the gas supply set to pass 30 cubic feet per hour each, which is the maximum required in heating either part of the system. Under this arrangement it is necessary to turn on the valves regulating the circulations before the gas controls can be opened, thus preventing an excess of power in the boiler, which would be troublesome in overheating, apart from the question of extravagance. Such an arrangement can only be conveniently applied to small systems of this nature; and in making any similar changes in apparatus, it is important to note that the valves usually fitted on the radiators or pipes must be removed and the entire regulation carried out from the heating chamber.

Conservatory Heating.

The warming of small conservatories and greenhouses is a use to which gas-heated circulation can be applied with advantage; and as in so many homes the glasshouse is the only requirement for this form of heating, the running expense of a gas-heated system is comparatively small, and can often be recommended. Its competitor, the coke-fired boiler, while acknowledged to be somewhat cheaper in fuel cost, stands at a disadvantage in regard to the frequent attention required; and unless carefully regulated it is difficult to keep alight through the night.

An example of heating a conservatory which may be described relates to an addition to a house some time after its erection. There was thus an objection to a flue having to be carried up the side of the building, making the use of a coke-boiler impossible. The conservatory has a cubical capacity of 5240 feet, in which it is desired to maintain a temperature of 45° Fahr., assuming the external temperature to be 30°. This is about the average demand in connection with warming conservatories, though as the external air is seldom down to 30° a somewhat higher temperature generally is obtainable. The apparatus installed has an aggregate heating surface of 142 superficial feet, consisting of two rows of 4-inch cast piping all round, connected to a single circuit of 1¼-inch wrought tube. This circuit passes wholly through the longest run of cast piping on the left-hand side of the house, after which it descends below the floor on account of the doorways; and from this the remainder of the apparatus is connected on the one-pipe system with air-vents at the highest points.

As a general rule, the heating of a conservatory of these dimensions would be designed in two sections, each connected separately to the boiler, in order to obtain an equal temperature throughout the apparatus. But owing to the level at which the feed-cistern stands, it was not possible to circulate over the doorways—a condition necessary in arranging the piping system in this way. The house, however, adjoins the conservatory on the right-hand side, so that it is sheltered in the part having the lower temperature in the heating system. The boiler provided for this work is a No. 20 "Victor," enclosed in an iron structure under the staging, with a hinged door to light it from the exterior. Ventilation is provided through the door, so that no fumes can enter the conservatory.

	Flow.	Return.	A.	B.	C.	D.
9.20	45°	45°	50°	50°	50°	50°
	Gas lighted consuming 87 ft. per hour.					
10 20	178	—	—	—	—	—
11.20	198	64	—	—	—	—
	Gas reduced at noon to 80 ft. per hour.					
12.20	205	92	66½	64	60	58½
	Gas reduced at 12.20 to 70 ft. per hour.					
1.20	205	106	69½	66	62½	62
	Water blowing out of expansion-pipe.					
1.40	205	107	70	67	63½	62½
	Gas reduced at 1.40 to 60 ft. per hour.					
2.40	200	106	69	66½	63½	63½
3.40	198	102	67	64½	63	61½
	Gas increased at 3.40 to 66 ft. per hour.					
4.40	206	104½	68	65½	64	61½

The above table gives particulars of a test taken upon the

completion of the job; thermometers A, B, C, D being placed in each corner of the conservatory, showing the atmospheric temperatures obtained, in addition to the others indicating the heating of the circulation.

Taking the average air temperature recorded by thermometers A, B, C, D at (say) 65°, this shows a rise of 15° from 50°, the temperature of the outside atmosphere; and though the prevailing winter conditions would be lower than this, a good margin in power exists, as the running gas consumption at the termination of the test was cut down 14 cubic feet below the normal hourly consumption of the boiler.

The apparatus was installed in December, 1911; but the conservatory did not come into use until the following February. From that time until the end of the season 6900 cubic feet of gas were burnt; while during the following full winter of 1912-13 the consumption amounted to 26,100 cubic feet. I am unable to say how the system was worked, though it is probable that it was only required in action during spells of weather below 40°.

Tests in a Workshop.

The following tests in connection with a heating apparatus are quoted to show the gas consumption required for various water temperatures. The apparatus contains 45 square feet of heat-losing surface in the radiators and pipes, which were fitted in a workshop having an iron roof and large glass window. The initial temperature of the air in the shop was 40°.

	Time.	Upper Thermometer in Flow Pipe.	Lower Thermometer in Return Pipe.
Gas consumption 36 ft. per hour.	9.30	40°	40°
	10. 0	118	40
	10·30	141	93
	11· 0	160	117
	11·30	175	131
	12. 0	186	142
Test continued with reduced gas consumption.			
Gas consumption 26 ft. per hour.	12.30	183°	147°
	1. 0	182	146
	1.30	182	145
	2. 0	181	146
	2.30	182	145
Test continued with reduced gas consumption.			
Gas consumption 20 ft. per hour.	3. 0	172°	142°
	3.30	166	136
	4. 0	164	132
	4.30	164	130
	5. 0	166	132
Test continued with reduced gas consumption.			
Gas consumption 15 ft. per hour.	6. 0	154°	133°
	6.30	148	122
	7. 0	142	118
	7.30	139	114
	8. 0	136	110
	8.30	134	108 gas out

A suitable temperature for general purposes in radiators for warming is 140° to 150°; and by the tests it is shown that this is obtained with a gas consumption of 20 cubic feet per hour, equivalent to an allowance of less than ½ cubic foot of gas per square foot of radiating surface per hour, which, however, would vary according to the external conditions.

As a calculation of running cost, an allowance of 25 feet of radiation per 1000 cubic feet of space will maintain a comfortable temperature in rooms when freezing outside; and it therefore follows that a large room of about 2000 cubic feet of space can be warmed for ¾d. per hour by this means, with gas at 2s. 6d. per 1000 cubic feet.

Circulating systems of radiators are less frequently adopted than portable gas-steam radiators, mainly on account of the pipe-work and contingent expenses incurred, though, where the circumstances permit, the circulating system is certainly the more satisfactory, notwithstanding the percentage of heat given to the chimney in the disposal of the products.

For factory purposes, where the visiting inspectors sometimes raise objections to the portable type of radiators, the circulating system successfully overcomes the difficulty, as a chimney can invariably be found somewhere in the rooms occupied, whereas with radiators ventilated separately through the external walls, to meet the requirements of the Factory Act, there is invariably greater total loss of heat than from a centrally-heated system.

DISCUSSION.

The President (Mr. J. Hewett, of the South Metropolitan Gas Company) announced that Mr. Potterton would be only too pleased to answer any questions, so as to give members what further information they might desire. He knew all the ins-and-outs of hot-water systems, and particularly of those which used gas for their fuel. Undoubtedly one of the great advantages of gas-heated hot-water systems was their easy method of control by means of thermostats, or by merely turning a cock on and off. No solid fuel was capable of such easy control. Towards the end of the paper, when dealing with gas-boilers and radiator systems for warming, the author had given a figure which would probably appeal to them more than ordinary statistics would do. He had stated that the cost of warming quite a large room by this means amounted to ¾d. per hour, with gas at 2s. 6d. per 1000 cubic feet. If a big living-room could be rendered comfortable at this cost, he did not think there was very much to grumble at.

Mr. F. C. Briggs (Gas Light and Coke Company) expressed the opinion that there was not a great deal to discuss in the paper. The author had done the very best thing in giving them some concrete cases and actual figures obtained. These examples would be useful to them when they had similar conditions to deal with. At the same time, of course, it had to be remembered that each individual case must be taken on its merits. The installation shown in fig. 1 appeared to him to be a very ingenious arrangement, which overcame a difficulty often met with in connection with flats. Connected with one of the large installations for domestic use illustrated in the paper, he noticed there were towel driers. This, of course, was nothing to cavil at; but speaking generally the use of the same system for heating and domestic work was a course which it might be thought well to guard against. In one part of the paper, mention was made of a certain arrangement for heating which had to be regulated by hand. This seemed to be quite a general idea; but he had never heard why the regulation could not be accomplished by thermostats. When hot water was used for domestic purposes, the heat was regulated in this way. In one of the arrangements, Mr. Potterton interposed a sealed vessel, but did not explain why. Towards the end of the paper, the author said a suitable temperature for general purposes in radiators for warming was from 140° to 150° Fahr. This seemed rather low; and he thought the majority of American specialists usually ran up to about 180° or 190°. Was it because gas was being used that this temperature was fixed upon, or had the sediment in the boiler anything to do with it? Undoubtedly, the higher the temperature at which one worked, the more sediment there was in the boiler. Sediment began to come down at about 120°, so there would be some at 150°.

Mr. Potterton said he would be inclined to adopt the form of apparatus shown in fig. 1 in many cases. Personally, he did not consider it had any disadvantages, provided the supply was limited to one or two points. In flats or places of the sort, where there was a restricted head of water, the difficulty was to obtain a good delivery at the tap. But the water authorities had certain regulations; and in certain cases, if he wished, an inspector might perhaps raise objections. He had known the arrangement to be criticized; but he had never found it to be actually prevented. As to another point, it was quite true that with radiators on domestic apparatus one was liable to get discoloration unless the apparatus was constructed to avoid this trouble. Combined systems of domestic supply and heating were quite workable where the conditions rendered the arrangement suitable. In the instance quoted, the towel-rails were of copper, and so water could be drawn through them without affecting the colour of the supply. As a matter of fact, however, owing to the arrangement of the installation, water would not actually be drawn out of the towel-rails, because they were floating pockets above the circulation, and the water in them would not be displaced to any extent. He had frequently known cases in which cast-iron radiators had been used for the same purpose, as they were cheaper initially than copper towel-rails; and even then there had been no complaint. The reason why they were unable to advocate the general use of thermostats for radiator systems was that the conditions were so varying that a thermostat set to any fixed consumption did not meet the case on every occasion. Moreover, if they put a thermostat on an installation consisting of (say) 200 feet of heating surface, it would be necessary to burn at least 50 cubic feet of gas per hour to maintain the heat in the system. In the last table of the paper, it would be seen that in the case of a radiator and pipes having 45 square feet of heat-losing surface, they would have to burn 20 cubic feet per hour to maintain a satisfactory temperature. So that, with a 200-feet installation, if they were to shut-down the gas by thermostat to 15 or 20 cubic feet per hour, the heat would not be maintained. There were other reasons against the adoption of thermostats for use with radiators. His firm always fitted a thermometer in the flow-pipe, so that people in charge could see that the water was not allowed to get beyond 200° at the outside. With an outside temperature of 45°, much less heat was required than when it was 30°; and a thermostat set one day would not be useful for another. One would have to keep on altering it. Turning on extra gas to afford the necessary heat required was the most satisfactory solution of the difficulty. As to the sealed vessel referred to by Mr. Briggs, this merely acted as a cushion. The system of circulation described was not in any way a natural one. What occurred was that the apparatus was filled up, and as the water reached a high temperature it was projected down to the lower part of the system. Replying to another query, he said the question of sediment did not come into account in heating apparatus, because one was not changing the water to any appreciable extent. Therefore they never considered the question of lime deposit at all. Americans, of course, sometimes worked to higher temperatures, but not with ordinary low-pressure hot water. If they tried to get their heating surfaces to 200°, they would be getting so near boiling-point that they would be evaporating the water; and this was a very expensive thing to do. They must proportion their heating apparatus to work at 150° or 160°, which would only necessitate a flow temperature from the boiler of about 180°. If they worked beyond this, it would be found that with the very slighest change in the temperature externally the water would be raised to steam point.

It was more economical to heat radiators to 150° than to 170° or 180°, so that it was best to calculate for a flow temperature not exceeding 170°. If working at a very low temperature—say, 100° or 110°—it was necessary to have a very large heating surface; and this was expensive to instal.

Mr. BRIGGS remarked that what had been said with regard to thermostats seemed somewhat of a condemnation of the existing types. What was required, it seemed to him, was a combination of a thermostat and boiler which would regulate the quantity of gas up and down as needed to keep the temperature constant.

Mr. POTTERTON replied that there were already such things; but they had not yet been designed to operate a gas-tap. They wanted a valve that would turn a tap; and at present he did not know of one. He found people were quite satisfied to undertake hand regulation, because it was far easier to regulate a gas-tap than it was to regulate a fire.

Mr. D. J. WINSLOW (Lea Bridge) said he had always regarded conservatory heating a very doubtful thing to advocate unless one was quite certain as to whether it was advisable to heat the place by gas or coke. It might be an advantage to some of the members to know approximately the length, breadth, and height of the conservatory dealt with in the paper. It would perhaps help them in any calculations they might have to make, though, of course, there were many local points which affected the matter considerably. The temperature, he imagined, would not be high enough for tropical plants.

Mr. POTTERTON replied that for conservatories 45° was a minimum heat; but generally people wanted more. The example cited by him was not a greenhouse, but just for plants that were "fully fledged." In this case, it was out of the question to have a chimney from a coke-fired boiler, because it would have been unsightly on the garden front. The gas-boiler, being worked without a chimney, got over the difficulty. The average height of the building would be 10 feet, and the other dimensions 25 ft. by 20 ft. It was nearly square.

Mr. WINSLOW: Have you tried using gas on a high-pressure heating system?

Mr. POTTERTON said that if they heated their water to very high temperatures, they would find they got proportionately much less heat out of the gas. The temperature of the water would be so near that of the gas that there would not be much interchange of heat. His firm did not recommend gas-boilers for very high temperatures in their radiator system. It must be admitted that there was no cheaper fuel than coke, taking heat for heat; but in a proper apparatus one could get a very high effect out of gas.

Mr. S. B. CHANDLER (South Suburban Gas Company) pointed out the enormous importance of the subject of gas-heated water—an importance which became still greater in view of the evolution of the flat. Many large outlying houses were being divided into three or four tenements or flats, each necessitating a system of hot water. The scientific application of gas to this purpose was receiving the careful attention of manufacturers of appliances. They all knew the Potterton apparatus; and in the district which he (the speaker) represented they had already made one or two excellent installations.

Mr. W. L. WESTBROOK (North Middlesex Gas Company) expressed the opinion that in the case of small greenhouses there was a fairly large field for gas, and that coke was not in it. The human element always came in; and one of the most important things was to have an equal temperature, which was difficult with a fire. His experience was, however, that the consumer often wanted a cheap job done. Frequently, the greenhouse was at the bottom of the garden, and a service had to be run this distance; and many of the installations that had proved failures had done so because the gas supply had been run-in and connected-up as quickly and cheaply as possible. The supply should be laid on properly, and then the apparatus would give satisfaction. Another cause of failure in heating greenhouses was the improper running of flue-pipes from gas-boilers. It was necessary to provide a tee-piece on the outlet. Referring, in one example given in the paper, to a possible danger of inter-circulation between the range-boiler and the gas-boiler, he said he had found, in connecting gas-boilers to domestic systems already in place, that it was often a rather bad plan to connect to the existing flow and return.

Mr. POTTERTON replied that in the case described inter-circulation could not occur, because the range-boiler and the gas-boiler were quite separately connected. Flue-piping through the roof of a conservatory was not a thing he should advocate, because it so soon got affected by condensation and perforated. In the case he had referred to, the boiler was enclosed in an iron chamber, which was ventilated; and this acted in the same way as a flue-pipe.

Mr. W. E. BROWN (Gas Light and Coke Company), who proposed a hearty vote of thanks to Mr. Potterton, referred to the excellent outlet which hot-water installations offered for both gas and coke. The gas industry, he said, owed a considerable debt to Mr. Potterton's firm for the work they had done in connection with the utilization of gas for this purpose. They were specially grateful to Mr. Potterton for reading his paper, seeing that he was suffering from the effects of a somewhat serious accident.

The HON. SECRETARY (Mr. A. R. Griggs), in seconding, pointed out that those undertakings which had been pushing the use of gas for water heating were reaping an advantage in these days of reduced lighting.

Mr. POTTERTON thanked the members for the vote, and assured them that he would at all times be pleased to give any information they might desire.

EFFECT OF PRESSURE ON THE COMBUSTION OF EXPLOSIVE MIXTURES OF GAS AND AIR.

[An Abstract Translation of a Communication to the "Journal für Gasbeleuchtung, by Herren E. TERRES and F. PLENZ."]

(*Continued from p.* 614.)

MIXTURES OF HYDROGEN AND AIR.—UPPER EXPLOSIVE LIMIT.

The reaction at the upper explosive limit may be regarded as a combustion of oxygen in excess of gas; and the degree of concentration of the oxygen is the important factor. In the analyses, therefore, the percentage of oxygen was determined primarily. The same apparatus as before was used, except that platinum wire was employed in place of palladium wire, in order to avoid absorption phenomena. As the oxygen is only one-third of the resultant contraction, the degree of accuracy of the determinations was double that of the determinations of hydrogen in the preceding section of the work.

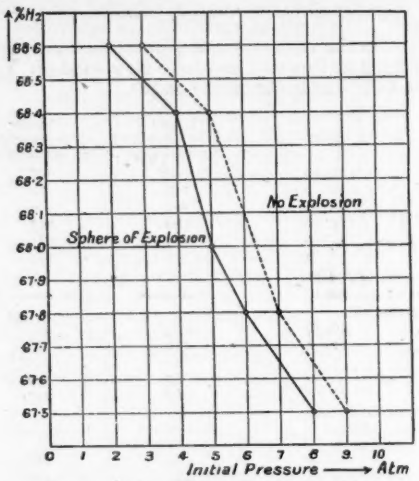


Fig. 3.—Hydrogen, Upper Explosive Limit.

Partial combustion did not take place—there was either no ignition or the oxygen present was entirely used up. Thus well-defined explosion limits were found. The effect of pressure on them is shown graphically in fig. 3, in which the abscissæ represent initial pressures in atmospheres, and the ordinates percentages of hydrogen in the mixture of air and hydrogen. The upper explosive limit is at 68·6 per cent. of hydrogen between 2 and 3 atmospheres pressure, and at 67·5 per cent. between 8 and 9 atmospheres pressure. These observations are accurate within 1 to 2 atmospheres.

MIXTURES OF CARBONIC OXIDE AND AIR.—LOWER EXPLOSIVE LIMIT.

The carbonic oxide used was prepared from formic acid and sulphuric acid, and was stored in a steel cylinder under pressure. It contained 98·2 per cent. of carbonic oxide; the balance being air having a small excess of nitrogen. Initially, it was free from iron carbonyl; but the latter portions of the contents of the cylinder contained traces thereof, which were removed by heating the gas in a tube filled with a spiral of copper.

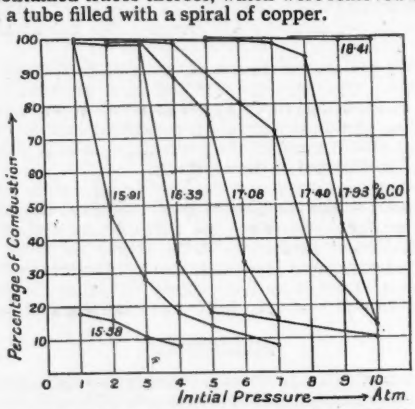


Fig. 4.—Carbonic Oxide, Lower Explosive Limit.

The investigations and analyses were made in the same manner as for the mixtures of hydrogen and air at the lower explosive limit. The degree of accuracy of the analyses was the same; but the carbonic acid directly produced formed a check on the results. The effect of pressure on the combustion is shown graphically in fig. 4, from which it will be seen that as the pressure is increased the range of the explosive mixtures is reduced. The pressure co-efficient of the explosive limit is about four times that for

hydrogen. There is no sharply-defined explosive limit. Partial combustion on every scale occurs; and there is gradual transition through a zone of partial combustions from the explosive to the non-combustible mixtures. At 1 atmosphere pressure 99 per cent. of combustion was obtained with 15·89 per cent. of carbonic oxide in the mixture, and at 10 atmospheres pressure with 18·41 per cent.

MIXTURES OF CARBONIC OXIDE AND AIR.—UPPER EXPLOSIVE LIMIT.

Carbonic oxide behaves in the same way at the upper as at the lower explosive limit, and thereby differs still further from hydrogen. Partial combustions on every scale occur. Owing to the fact that when present in excess some carbonic oxide is converted by combustion over incandescent wire into carbonic acid and carbon, the analyses could not be made by this combustion method. The oxygen was therefore determined directly by absorption with phosphorus. The degree of accuracy of the analytical results was not so high as in the work on hydrogen—the error being one-and-a-half times as great as for either gas at the lower explosive limit. Moreover, since the investigations were made with gaseous mixtures saturated with water vapour, there was at the upper explosive limit some conversion of carbonic oxide and water vapour into carbonic acid and hydrogen; and the determination of the carbonic acid in the gaseous mixture resulting from the combustion did not therefore serve as a check on the oxygen consumption unless the resultant hydrogen was also determined. This was done in several instances. In three, the percentage of the water vapour present which was converted into hydrogen was found to be about 50, 60, and 70 respectively.

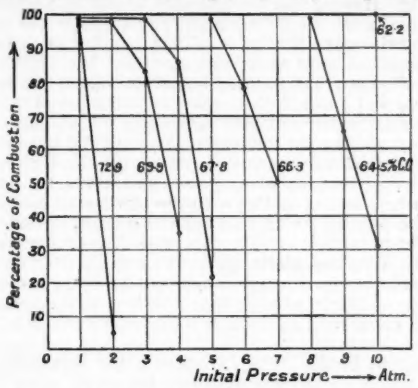


Fig. 5.—Carbonic Oxide, Upper Explosive Limit.

The effect of pressure on the combustion is shown graphically in fig. 5. At 1 atmosphere pressure 99 per cent. of combustion was obtained with a mixture containing 67·8 per cent. of carbonic oxide and 6·70 per cent. of oxygen, and at 10 atmospheres pressure 100 per cent. of combustion was obtained with 62·2 per cent. of carbonic oxide and 7·87 per cent. of oxygen.

MIXTURES OF METHANE AND AIR.—LOWER EXPLOSIVE LIMIT.

The methane used was natural gas from Kissarmas, in Transylvania, containing 99·1 per cent. of methane, the balance being air. The methane in the gaseous mixtures was determined in the same way as the hydrogen and carbonic oxide for the lower limit researches, except that a somewhat longer quartz tube with palladium wire of several strands was used, and was brought to a bright red heat by a Teclu burner. By this means complete combustion of the methane was ensured. The degree of accuracy of the analyses was twice that of the analyses for the other two combustible gases at the lower limit, because methane consumes twice its volume of oxygen and its volume is one-third of the contraction which takes place.

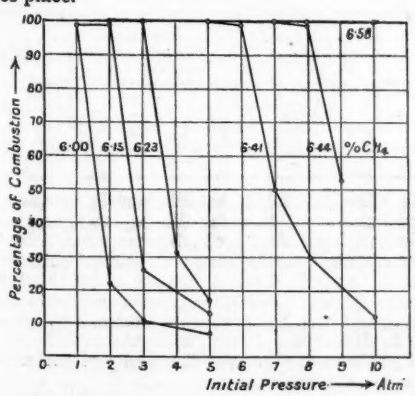


Fig. 6.—Methane, Lower Explosive Limit.

When partial combustion at a lower temperature was carried out, it was found that, owing to there being an excess of oxygen present, all methane which entered into reaction at all was completely oxidized to carbonic acid and water—no carbonic oxide and hydrogen were formed. The effect of pressure on the percentage of combustion is shown graphically in fig. 6. The shifting of the lower explosive limit with a change of pressure from 1 to 10 atmospheres was fairly small—viz., about the same as for hydrogen. Thus between 1 and 2 atmospheres the lower explosive limit is at about 6 per cent. of methane, and between 9 and 10 atmospheres at about 6·5 per cent. In respect of the extent to which partial combustion occurs, methane comes midway between hydrogen and carbonic oxide.

MIXTURES OF METHANE AND AIR—UPPER EXPLOSIVE LIMIT.

The observation of the combination phenomena of mixtures of methane and air about the upper explosive limit is difficult, owing to the complexity of the reactions which occur. The incomplete combustion of methane may lead to the formation of water gas. It seemed possible that after explosion there might be found in the gases left in the bomb, carbonic acid, water vapour, carbonic oxide, hydrogen, free methane, and free oxygen. [Free oxygen had been found in the products of combustion of carbonic oxide at the upper explosive limit.]

The analysis of the mixture of methane and air used was made by combustion over palladium wire after air in excess had been added. The analysis of the resultant products from the bomb comprised absorption of carbonic acid in the usual way, absorption of oxygen with phosphorus (which, however, always gave negative results, as the gases proved to be free from oxygen), and fractional combustion, with additional air, of the combustible gases. Owing to the changes of volume and the addition of air, the calculation of the results in relation to the original volume of gas taken was rather complicated. The authors give examples to illustrate their procedure. The products of combustion were always free from both oxygen and methane; the latter having been split up, and the oxygen having been distributed to produce a mixture of carbonic acid, carbonic oxide, water vapour, and hydrogen. The proportions of these gases were determined; and the mean value of the constant K in the equation

$$K = \frac{CO \times H_2O}{CO_2 \times H_2}$$

was found to be 3·24, which, according to the curves of Haber and Hiller, corresponds with the equilibrium of the water-gas reaction for a temperature of about 1400° C. The thermodynamic temperature which this figure represents is probably not the maximum attained in the explosion, but may be assumed to be the temperature reached by cooling, at which the velocity of the reaction has become so low that the equilibrium remains in abeyance. The calorimetric temperature, calculated from the heat liberated in the reaction and the specific heats of the products, was 2080° C.; but this could not actually be attained, because the combustion is not instantaneous, and there are losses by cooling. It is, however, so much higher than the thermodynamic temperature that the latter must be taken to represent the point at which the continuance of the water gas equilibrium ceases. This assumption is confirmed by Hiller's work, which proves that when cooling to 1400° C. occurs, the water gas equilibrium remains in abeyance.

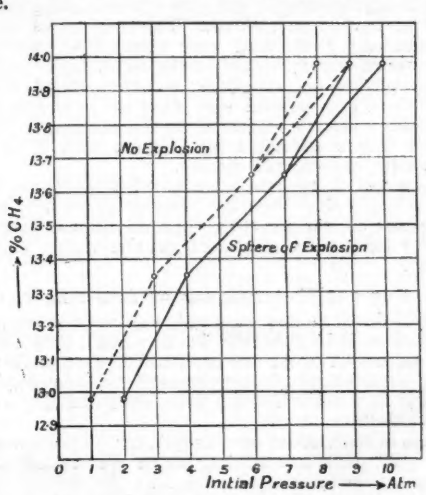


Fig. 7.—Methane, Upper Explosive Limit.

The results of the experiments on the effect of pressure on the combustion of mixtures of methane and air at the upper explosive limit are shown graphically in fig. 7. No partial combustion occurs—the mixture either explodes completely, with formation of water gas, or it does not ignite; hence the explosion limit is well defined. Between 1 and 2 atmospheres pressure it corresponds with 12·98 per cent. of methane; and between 8 and 9 atmospheres, with 13·98 per cent. of methane. At the lower pressure stated in each case the mixture does not explode, whereas it does explode at the higher of the two pressures. Methane differs from the other two gases, with which increase of pressure reduces the upper explosive limit. Probably this difference is due to the effect of the reactions which occur with methane at the upper limit on the pressure co-efficients.

(To be continued.)

THE ESTIMATION OF NAPHTHALENE IN SPENT OXIDE.

By William C. Davis, B.Sc. (Lond.), F.I.C.

[A Paper read before the Birmingham Section of the Society of Chemical Industry, and Reprinted from the Society's "Journal."]

The ordinary spent oxide from gas-works contains very little, if any, naphthalene. The sample, however, which is the subject of this examination had been used in the Williams process for the extraction of cyanogen from gas, and contained a considerable quantity of naphthalene. It must, therefore, be assumed that the Williams process has in this case purified the gas, not only from cyanogen, but also from napthalene.

The naphthalene is usually determined by means of picric acid as described by Colman and Smith,* Kuster, and Dickenson-Gair.† These methods deal with the estimation of the naphthalene in coal gas; but Dickenson-Gair gives a method for the estimation in spent oxide by dissolving-out the naphthalene with alcohol, and precipitating the clear solution with picric acid. No details are given.

A method for estimating naphthalene in tar is described in Lunge's "Technical Methods of Chemical Analysis," Vol. II., p. 803. This method, which is proposed by White and Ball,‡ consists in weighing about 1 gramme of tar into a 50 c.c. Erlenmeyer flask provided with an air inlet and connected to a U tube. The first two-thirds of the tube is filled with quicklime, and the remaining space with glass wool and phosphorus pentoxide. The entire apparatus is heated in an air-bath at 70° to 80°. The outlet of the U tube is connected outside the air-bath with a weighed second U tube immersed in ice-water. A current of air is drawn through the apparatus at a velocity of 2 litres per hour, which causes the naphthalene to volatilize and deposit in the cooled U tube. The operation is continued until the second U tube no longer shows an increase in weight.

For the separation of the naphthalene from spent oxide, the method of White and Ball (modified as described below) and also distillation with steam have been employed; and this latter method has proved more satisfactory.

Separation of the Naphthalene by a Current of Warm Air.

Working with this method, great difficulty was experienced in completely volatilizing the naphthalene. First of all, 10 grammes of the spent oxide were weighed into a bottle fitted with inlet and outlet tubes, so that a current of air could be drawn through it. The air current was passed for two hours over the sample of spent oxide; then through a 10 per cent. citric acid solution, to retain any ammonia; and then through three wash-bottles containing measured quantities of a saturated picric acid solution of known strength, in which any volatilized naphthalene is collected. The bottle containing the sample, and also that containing citric acid, were kept at 100° in an air-bath. The contents of the wash-bottles containing picric acid were then mixed together in a tightly stoppered bottle; heated in the water bath until all the naphthalene picrate was dissolved; and then cooled, with occasional shaking. The solution was made up to known volume; the naphthalene picrate separated by filtration; and the picric acid in the filtrate estimated by titration with $N/10$ sodium hydroxide, using lacmoid as indicator.

When a current of dry air was used to volatilize the naphthalene the quantity found after two hours' treatment was 1·35 per cent., and with moist air 1·9 per cent. In both cases an examination of the spent oxide after treatment showed visible crystals of naphthalene.

Separation of the Naphthalene by Steam Distillation.

The naphthalene, as was expected, was very easily removed from the spent oxide by steam distillation; and a simple and easy method of estimation of all the naphthalene as picrate was devised. The naphthalene picrate obtained was examined in order to find out if any other hydrocarbons were distilling over and interfering with the estimation.

The details of the method were as follows: 10 grammes of the sample of spent oxide are weighed into a Würtz flask, and subjected to steam distillation. The steam and vapours of the distillate are passed through a second small Würtz flask heated to 100° C., and containing 50 c.c. of N sulphuric or citric acid; then into a condenser; and finally into a receiver consisting of a wide-mouthed bottle. The whole apparatus is sealed by placing at the exit a wash-bottle containing 25 c.c. of a saturated picric acid solution. The distillation takes about 10 minutes. After this has taken place, the water in the condenser is regulated so as to allow any naphthalene to melt and run into the receiver. As soon as this is the case the picric acid seal is washed into the receiver, and a further 125 c.c. of picric acid solution added. The receiver is closed with a rubber bung and heated in the water bath until a clear solution is obtained. It is then cooled, with occasional shaking; and the excess of picric acid is determined by titration with $N/10$ sodium hydroxide. The whole estimation takes about an hour and a half. The following results were obtained on samples from the same lot of oxide: 3·06, 3·88, 2·98, 2·80, 3·16, 2·79, 2·81 per cent. of naphthalene.

It was decided to test the method in two ways—by examining the naphthalene picrate for purity, and by estimating known weights of naphthalene added to the oxide previously freed from naphthalene by steam distillation.

Examination of Naphthalene Picrate for Purity.

The naphthalene picrate obtained was subjected to steam distillation; and the naphthalene produced was dried by pressure between filter paper, and the melting point determined. The residue of picric acid in the distilling flask was titrated with $N/10$ sodium hydroxide, and the amount obtained compared with that in the naphthalene picrate taken. The melting point of the naphthalene was only from 1° to 3° below that of pure naphthalene, which melts at 79° C.; so that there could only have been a very small quantity of other aromatic picrates present, if any. The quantity of picric acid obtained from the naphthalene picrate was less by 25 per cent. than that estimated as having been combined with the naphthalene, as might be expected, since the naphthalene picrate is slightly soluble in the mother liquor and the water used for washing it.

Determinations with Known Quantities of Naphthalene

For the estimation of known quantities of naphthalene, it would have been best to make up a mixture similar in composition to the spent oxide, containing known quantities of naphthalene; but this was considered almost impossible on account of the complexity of the mixture and the difficulty of getting a known quantity of naphthalene to diffuse uniformly through the mass. In order to work under similar conditions as far as possible, the check estimations were made by separating the naphthalene by steam distillation from 10 grammes of the oxide. When all the naphthalene had distilled, the apparatus was allowed to cool; and then a known quantity of naphthalene was added and estimated as described above. In the earlier stages of the investigation, it was found that the formation of the naphthalene picrate takes place much more readily when the solid naphthalene in the distillate is crushed before heating with the picric acid solution; and, again, if the heating be carried out too quickly the naphthalene has a tendency to melt, and in this state it seems to react only very slowly with the picric acid. The method as carried out above appears to give results which are 10 to 15 per cent. low. It was thought that a possible source of loss might occur in that the 150 c.c. picric acid solution are diluted by the distillate and by the water necessary to wash the tubes and the catch bottle into the reaction bottle. The volume of liquid obtained is usually 195 to 205 c.c. at 33 per cent. dilution—the result being that some naphthalene picrate dissolves in the weak liquor. A series of tests was, therefore, carried out with weighed amounts of naphthalene, in which (before heating the naphthalene with the picric acid solution) sufficient solid picric acid was added to make the whole solution saturated. The results obtained are given below.

Weight of Naphthalene Taken.	Per Cent. $C_{10}H_8$ Taken.	Weight of Naphthalene Found.	Per Cent. $C_{10}H_8$ Found.	Error. Per Cent.
0·34 gms.	3·4	0·306 gms.	3·06	− 10
0·29 ,,	2·9	0·302 ,,	3·02	4
0·31 ,,	3·1	0·310 ,,	3·10	*Nil*

A series of estimations was next made on the original spent oxide, to compare the two methods—*i.e.*, with and without the addition of solid picric acid. In each case slightly higher results were obtained in those experiments in which the solid picric acid was used; the difference agreeing fairly well with the results previously obtained:—

No.	Per Cent. $C_{10}H_8$ by Original Method.	Per Cent. $C_{10}H_8$ by Adding Solid Picric Acid.	Difference. Per Cent.
1	..	2·92	..
2	2·63	2·77	5·4
3	2·57	2·86	10·1
4	2·61	2·91	10·3

Therefore when estimating naphthalene in samples of spent oxide, or in similar cases in which the naphthalene can be separated in a state of sufficient purity by steam distillation, a sufficiently accurate result will be obtained for most purposes if, after the distillation, crystals of picric acid are added to the distillate in such a quantity that the resulting solution is saturated. But for a working test this is, perhaps, not necessary. It does not follow that in all samples of spent oxide the naphthalene can be estimated by this method, unless the purity of the naphthalene picrate is tested as noted above.

As a sample of spent oxide which was the subject of the above examination has been shown to contain a higher percentage of naphthalene than is usually found in spent oxides, it was examined as to its content of solid soluble in water, tar oils, and sulphur. The following values were obtained: Soluble in water, 4·95 per cent. (ammonium thiocyanate, 71·45 per cent.; ammonium

* See "Journal," Vol. LXXV., p. 798.

† *Ibid.*, Vol. XCII., p. 749; Vol. C., p. 770. ‡ *Ibid.*, Vol. LXXXVIII., p. 262.

sulphate, 9·9 per cent.); tar oils, 1·78 per cent.; sulphur, 30·32 per cent.

Discussion.

Dr. W. B. DAVIDSON said the author appeared to him to have achieved a satisfactory result, though there did not seem to be any great use in an estimation of this kind. In the Williams process there was occasionally some difficulty in the extraction of cyanogen, and the presence of naphthalene in the boxes containing spent oxide was no doubt due largely to the fact that liquor or water sprayed in at intervals had a condensing effect. The naphthalene was, therefore, gradually collected in the boxes; and it was certainly a nuisance in the process if the gas under treatment was pretty well laden with naphthalene. Ordinary spent oxide was very often acid. So much depended upon whether or not air was passed through the purifiers. In the Williams process the spent oxide was naturally alkaline, because the liquor generally contained 4 to 6 per cent. of ammonia.

Mr. PICKERING said he had tried washing the oxide with a warm solution of picric acid, practically saturated; finally washing the oxide with a little water and thus preventing loss, and then estimating the naphthalene in the picric acid. He checked the method by adding naphthalene to a sample of oxide which had been washed with picric acid; and he found his results came to within 95 or 96 per cent. of agreement.

Mr. F. H. ALCOCK asked if Mr. Davis had found sulphuric acid with the naphthalene in the distillate. He would have thought it important to look for other acids than picric. There might be present other things than naphthalene and picric acid. It might be advantageous to add a volatile agent to the spent oxide, and then distil the naphthalene. Or the boiling point of the liquid containing the naphthalene might be raised by adding salt, shaking the distillate with ether, and then evaporating slowly. He did not agree that the detection in gas-works spent oxide was of little importance, because if its vapour could be carried to the houses there would be a better illumination.

Dr. DAVIDSON replied that the vapour of naphthalene would afford no advantage. The boiling point was 218° C. The vapour tension at ordinary temperatures was so low that the gas could not carry 0·008 per cent. by volume; and this was only equivalent to the light of a small fraction of a candle power.

Mr. DAVIS, in reply, said he did not think the washing of spent oxide with picric acid would be effective in samples from the Williams process, because ammonia was present. Further, there would be a loss of naphthalene before the process was finished, owing to the time required for washing.

MODERN DEVELOPMENTS IN BYE-PRODUCT COKING.

At a Meeting of the Mining Institute of Scotland held in Glasgow last Saturday week, Mr. G. STANLEY COOPER, of Sheffield, read a paper, illustrated with lantern slides, on "Notes on the Manufacture of Bye-Product Coke, with Special Reference to the Koppers' Process."

At the outset the author said that bye-product coking had not developed in Scotland to the same extent as in the North of England. This could be put down principally to two facts—first, Scottish ironfounders had not been dependent on coke for their furnaces, on account of splint coal being available; and secondly, much of the Scottish coal as mined at present offered certain difficulties to treatment in bye-product ovens. According to the report of the Chief Inspector of Mines for 1912—the latest available official information—there were in operation in Scotland 861 beehive ovens and 417 of other kinds, including 348 of the bye-product type. The production of coke was given as follows:—

	Tons.
Dumbarton (including Ayr and Linlithgow)	68,119
Lanark	203,111
Stirling	356,572
Total	627,802

This production of coke corresponded approximately to the carbonization of a little above a million tons of coal per annum, or about 6 per cent. of the total quantity of coal carbonized in coke-ovens in Great Britain. It would be seen, therefore, that the coking industry was of substantial importance in connection with coal mining in Scotland; and he believed he was correct in saying that the extension of the industry in Scotland was occupying the minds of many colliery owners in the country. The principal feature operating in this connection was the gradual exhaustion of the splint coal in many districts. Although supplies were ample for some time yet, those responsible were keeping an eye on the possibility of either supplementing or supplanting splint coal by coke.

Several new coalfields were being opened up at the present time; and he was quite sure that those who were extending would be only too delighted to strike a seam of really good coking coal. It was to be anticipated, therefore, that bye-product coking would increase in Scotland in the near future. Accordingly, in the paper it was proposed to direct attention to some of the circumstances connected with the carbonization of Scottish coals, and also to suggest what he considered to be very feasible schemes of operation. He had examined in the laboratory a number of coals from various parts of Scotland; and, judging from tests carried out, he estimated the probable yield of coke to be about 65 per cent., sulphate of ammonia 1·5 to 1·7 per cent., tar 4 to 6 per cent., and crude benzol about 3 gallons per ton of coal. These were certainly much better yields of bye-products than were obtained in many parts of Great Britain.

The author next described in detail the installation of Koppers ovens at the Birmingham Corporation Gas-Works. The plant consists of 66 ovens, capable of dealing with 660 tons of coal per day when using uncompressed coal, and 560 tons when compressed coal was used. The difference was accounted for by the fact that in the latter case wet coal was employed, and therefore the carbonizing period was longer than with dry coal. Mond producers were employed. There were five producers, each capable of gasifying 22½ tons of fuel per day. The producer plant had its own fuel-handling equipment, and was arranged for the recovery of tar and ammonia from the gas. The Koppers oven as adopted at Birmingham was a development of the ordinary Koppers regenerative coke-oven.

Describing the Koppers regenerative gas-oven, the author said: In coke-works the principal aim is, of course, to produce the best possible quality of coke suitable for metallurgical purposes. The gas obtained is used principally for heating the coke-ovens, for boiler-firing, and for gas-engines. In gas-works, on the other hand, and also in many other cases, an equally important object is the production of the greatest possible amount of illuminating gas. After careful consideration and experiment, Mr. Koppers saw that, by making slight alterations in design and practice, his successful regenerator coke-oven could be adapted for use as a gas-oven, and as such could be rendered capable of producing a high yield of gas of good and even quality, and suitable in every way for "town" purposes. At the same time, the coke obtained would not deteriorate in quality, and would be far superior to ordinary retort coke. The most important alteration thereby necessitated was that the whole of the gas evolved from the charge should be available for illuminating purposes; hence some other means must be found for heating the ovens. Mr. Koppers decided that this was best dealt with by the introduction of a central producer-gas plant erected quite apart from the chamber-ovens. The producer gas was further to be preheated before combustion, just as the air is preheated in the case of the regenerator coke-oven. Consequently, the design of the oven was altered slightly in order to accommodate these new features. In the main, however—especially as regards the arrangement of the heating flues—the oven remains unaltered.

The construction and working of the Koppers oven is exceedingly simple. The oven walls consist of a series of hollow columns reaching from the top to the bottom of the structure, thereby assuring the strongest possible construction and resistance to strain. All the other parts of the ovens are made as strongly as is compatible with the requirements. Every working part can be inspected without difficulty and without discomfort.

When working with a charge of 10 tons of dry coal per oven, a carbonization period of twenty-four hours is required; and at the end of this time the charge is quite burnt-off. The coke obtained is of excellent quality, and, owing to the minimum amount of handling it undergoes, very little breeze is produced. The efficiency of the charging machinery is such that each oven can be completely discharged, re-charged with 10 tons of coal, the ascension pipes cleaned, and the oven set working again in less than 10 minutes.

As previously stated, the producer gas is supplied from a Mond plant, consisting of five standard Mond producers; and these are arranged with a plant for recovering tar and ammonia from the producer gas. Warwickshire nut coal is used in the producers. The gas leaves the producers at a temperature of about 750° to 930° Fahr. (400° to 500° C.), passes through a heat exchanger, and then into a washer. The dirt and dust are thereby eliminated from the gas, and the ammonia is absorbed in sulphuric acid. Before passing to the ovens, the gas is led through scrubbers containing sawdust and wood-shavings, in order to remove all traces of tar. The tar recovered from the producer gas is distilled in a continuous still; creosote oil and pitch being produced.

At other plants of this type built on the Continent the Kerpely revolving grate-producer has been used with great success. In such cases, however, there is no recovery plant.

Dealing with the recovery of the bye-products from coke-oven gas, the author said: Until about the year 1880 no successful attempt had been made to recover the bye-products from coke-oven gas. Since then, however, great progress has been made; and the methods now adopted are remarkably efficient. Originally the same method was used as is employed at gas-works; but this is admittedly a roundabout way. In the gas-works method the gas is first cooled down to atmospheric temperature, and all the tar and ammoniacal liquor removed by condensation. The gas is then thoroughly washed with water, in order to remove all the ammonia. This solution, together with the condensed ammoniacal liquor, is then subjected to distillation and the ammonia gas driven off and passed into sulphuric acid.

Various attempts have been made to eliminate the washing process and to pass the gas directly into sulphuric acid. Many difficulties were encountered, however, and these were principally on account of the removal of the tar from the gas. Such systems are known as direct-recovery processes; and the first to meet with any commercial success was that devised by Mr. Koppers.

This process has since been largely adopted, and at the present time deals with the gas from upwards of 20 million tons of coal per annum. It is a remarkable fact that, despite the undoubted success of the direct-recovery process, no large gas-works in this country has yet been sufficiently progressive to depart from the old method and to instal direct recovery. It is, however, installed at Budapest.

With regard to the question of effluent liquor, it has been pointed out that in the Koppers process this is reduced to about one-half the quantity which is produced in the old process. It is claimed that in the hot process the production of effluent liquor is entirely avoided; but, unfortunately, this claim cannot be substantiated.

The production of effluent liquor can only be avoided when dry coal is carbonized, and where benzol is not recovered. In gas-works practice the liquor would be condensed prior to the purification of the gas. At the present time the more usual practice entails the use of coal containing 10 to 12 per cent. of added moisture and the recovery of benzol. In the former case, if no liquor is to be produced, the steam formed during the distillation of the coal has to be taken through the bye-product plant and back to the ovens, and thence, in the waste-gases, to the boilers and chimney without condensation taking place. As the volume of the steam in such case is more than the volume of the gas alone, it necessarily follows that more than double the power is required to drive the steam and gas through the plant than is necessary in the Koppers process, where only the gas has to be dealt with. The heavy expense in providing steam and power for this purpose and for driving the tar-sprays is much greater than would be involved in evaporating or otherwise disposing of the comparatively small amount of effluent liquor that is produced in the Koppers process.

The recovery of benzol has received considerable attention of late, owing to the fact that much refined benzol is now being used in place of petrol as fuel for motor-engines. The majority of coke-oven plants now have benzol-recovery plants; but very few indeed produce refined spirit—what is known as "crude" or "65 per cent." benzol being generally made.

On all bye-product coke-oven plants in this country the benzol can be extracted from the gas without affecting the amount of energy obtained from it when used for boiler-firing purposes or for combustion in gas-engines, by more than about 5 to 10 per cent. The quantity of benzol obtainable differs, of course, according to the nature of the coal. In South Yorkshire, Derbyshire, the Midlands, and Cumberland, the yield is about 2½ to 3 gallons of crude spirit per ton of coal; in Durham, it is about 2 to 2½ gallons; while in South Wales it is only about 1 to 1½ gallons. Consequently, very few of the coking plants in South Wales recover benzol, as it would not pay, except with a large installation.

The recovery of benzol from coke-oven gas is now universally effected by means of absorption in creosote oil—a product obtained in the distillation of coal tar. The difference between the various systems on the market lies principally in the internal arrangement of the apparatus employed, and the temperature and steam-pressure at which the various parts are worked.

Discussion on the paper was adjourned till a future meeting.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Yorkshire Junior Gas Association took place on Saturday last, at the Bradford Corporation Gas Department show-rooms, in Darley Street, Bradford—Mr. JOHN W. LEE, the President, in the chair.

Mr. E. J. SUTCLIFFE, the Deputy Gas Engineer at Bradford (acting in the absence of Mr. Charles Wood, the Gas Engineer, who had been called away from the city by family bereavement), extended a hearty welcome to the members. He said that, though these extensive show-rooms had only been open three months, the business done had amply proved that such a place met an urgent need.

The PRESIDENT, in thanking Mr. Sutcliffe for his welcome, said the Association had many reasons to thank Bradford. The city had the biggest representation in the Association of any town, and many times they had come to Bradford for meetings and visits to the works.

Mr. ERNEST C. BOUGHTON, of the Bradford Gas Department, then read a paper on:

INCREASING THE SALES OF DOMESTIC COKE.

Members of the Association will remember that rapidly accumulating stocks of coke caused some concern among gas undertakings at the beginning of last winter. In Bradford, we determined to combat this state of affairs by endeavouring to stimulate the local demand—particularly for domestic (or broken) coke.

It will not be disputed that gas undertakings—corporations and other local authorities more especially—have not up to the present evinced much enthusiasm for local publicity as a means of extending the sale of the commodities they supply to the public; and there is reason to conclude that their attitude generally is sceptical and lukewarm towards devices and ideas which to an up-to-date business concern, dealing direct with a public, are factors essential to the welfare and prosperity of the business. The British Commercial Gas Association has accomplished splendid work but it seems to the writer that its activities require to be supplemented by vigorous local effort if the Association is to attain its maximum utility to the industry. As regards coke, however, the Association has to remain all but impotent, because of an insufficiency of funds to push coke as well as the parent commodity gas; so that undertakings are entirely dependent upon whatever endeavours they are individually prepared to make in order to encourage the purchase of coke.

When it is realized that only about 15 per cent. of the public of Bradford use coke in their homes for any purpose, it leads one to ask, "What can be done to convert a portion of the remaining 85 per cent. from the use of coal to the use of coke?" Prior to last winter no advertising, aimed at increasing the local demand, had been undertaken in Bradford beyond the distribution of handbills on two or three occasions. These handbills, although they might have been useful as a unit in a scheme of advertising, were insufficient of themselves to cause any considerable growth upon the virgin soil; so that no perceptible impetus to local domestic coke sales resulted. In October, 1913, we began to give more earnest thought to the potentialities of publicity in this connection; and our effort, though a modest one, was a good deal in advance of anything we had attempted before.

THE METHOD.

The campaign took the form of a facsimile typewritten circular-letter, sent, with a printed order post-card, to all householders—about 55,000 in number—residing within a reasonable distance of our various gas-works. The circular was enclosed in an envelope, sealed, and addressed to the householder in person. The main arguments put forward in the letter were: The cheapness of coke, the necessity (in view of the inflated prices of coal) to choose an alternative fuel, the intense heat given out by coke, and the fact that it is smokeless and every citizen using it contributed, in a small measure, towards the elimination of the smoke nuisance. Advice regarding its proper use, and particulars of prices, &c., were included.

Considerable thought and care were exercised in constructing the circular-letter, in order to obtain the correct "tone" necessary in a communication emanating from a department owned by the municipality. Flippancy, exaggerated language, or a conversational style had to be avoided on the one hand, and an official "take it or leave it" tone on the other. The letters bore the facsimile signature of the Gas Engineer and Manager, and were addressed from the head offices of the Gas Department at the Town Hall.

The circular was printed in purple ink in facsimile typewritten characters. The intention was, of course, to create the impression that the letter was a personal one from the gas engineer to the gas consumer. No one fairly well acquainted with business devices and ruses would have been deceived into thinking that the letter was a personally typed one; but the average householder is not well versed in these matters, and we had reason to know that in many cases the desired impression had been made. An alternative method of producing the circulars would have been by the Roneotype (or similar) process—type set up in the usual way, but the impression made through a texture resembling a typewriter ribbon. In our case, however, we did not consider this method—which is much more expensive—to be necessary or suitable for the purpose intended.

The post-card selected for the 1913-14 campaign was a white card of fairly good quality. A little care to ensure that the card conforms in every way to the official requirements of the postal authorities may not be out of place. It may seem a trifling point to mention; but the possibility of being surcharged postage on thousands of cards returned through the post justifies a little preciseness in matters of this kind.

The circular and card were enclosed in an envelope bearing on the face the inscription: "From the Bradford Corporation Gas Department." The fact that it came from the Gas Department would at least ensure its being opened, as the recipient would not be sure that the envelope did not contain an account or some other important document.

Every one of the 55,000 envelopes was addressed by hand. This work, together with enclosing and despatching, was no light task; and unless a good, speeded-up system of work be devised, the impression made upon the vast bulk of stationery will be surprisingly slight even if a large staff is employed.

The circulars, after being parcelled-up, counted, and placed in exact street order, were delivered by our corps of meter inspectors, who devoted several Saturday mornings to the work.

THE RESULT.

The result was that every post from the beginning of November (when the despatch of the circulars began) to the end of March brought its quota of post-cards. The highest number received in one day was over 300—deliveries of 100 and 50 being frequent. Altogether we have had 5500 of the cards returned, or about 10 per cent. of the total number sent out. Of course, some of the orders were given by people who were already regular users, as we did not discriminate between customers and non-customers in addressing the circulars; but a large number of them were new. Twelve months have elapsed since the public received the circulars and cards, but a few are still being returned each week.

It is well known by those who are acquainted with the subtleties of the science of advertising that immediate, "by return of post," results should never be expected. Advertising is a profitable

investment only if it is sustained, systematic, and sensible, and so devised that the customer to be captured sees the announcement of the wares offered when he turns to the north, the south, the east, or to the west, and when he again turns to the north. Although it is unreasonable as a rule to expect an isolated advertising effort unsupported by any other form of publicity to yield a marked degree of success, yet our campaign did stimulate the local demand for domestic coke very materially.

For a period of 26 weeks prior to the commencement of the campaign, our output of domestic coke did show a consistent decline week after week of hundreds (sometimes thousands) of bags compared with the figures for the corresponding weeks of the previous year. The average decrease over the period named was about 2000 bags per week. That the falling away of the output was not of an ephemeral nature, and looked like being a permanent loss of custom unless arrested, is borne out by the fact that no single week recorded an output equivalent to the previous year's business.

Without any alteration in price or any unusual inclemency of weather—the winter was, indeed, rather milder than the previous one—and without any other outside factor to obscure the issue, the decline just referred to was wiped out in a short space of time; and thereafter our output of domestic coke showed substantial increases week by week. A figure which was a record for the department—coal strike periods excepted, when, of course, the demand is phenomenal—was reached five weeks after the campaign commenced. This improved state of affairs has continued right up to the present; but the demand has been still further accelerated by this winter's effort, referred to later.

About half of the returned post-cards were followed up within a reasonable period by a circular-letter asking the customer to place a standing order, and enclosing a stamped reply post-card. Nearly half of these repeat order cards were returned; and they are still coming in at the rate of a dozen a week, although it is twelve months since the customers received them. The fact of people carefully preserving these order cards for a period of some twelve months is rather a pleasant one, and tends to prove that future results, as well as immediate ones, accrue from a satisfactory advertising effort.

Later in the winter [February] we prepared a card-folder bearing a half-tone illustration on the face to give it an attractive appearance, and particulars, merits, and prices of coke printed within; a tear-off order post-card forming part of the folder. Although it was not to be expected that these would be as effective as the direct personal appeal made by the more elaborate scheme, we nevertheless had over 1500 returned within a month; and they continue to arrive at the rate of twenty or thirty a week.

This Year's Campaign.

This year we have proceeded very much upon the same lines as last. The Gas Committee recently made a substantial reduction in the price of coke; so we made this fact the predominant feature in the circular-letter. A postscript was added announcing the opening of the new show-rooms. Record business at the show-rooms began shortly after the despatch of the circulars was commenced—whether as the result of the circulars, or owing to the coincidental approach of winter, we are not in a position to determine.

A space was provided on the face of this winter's post-card for the customer to give a standing order if he so desired. This has turned out to be a happy idea. The campaign was begun about the middle of October, and already no fewer than 6500 cards have been sent in, ordering upwards of 20,000 bags—about 1800 of the cards gave standing orders.

The combined result of the publicity and reduction in price had the effect of inundating us with orders for a time; and we have been obliged to hold-up the completion of the campaign in order to give our coke despatching staff time to cope with the situation, as our resources for breaking and delivering became somewhat strained. Our output of domestic coke during the week ending Nov. 25 totalled 14,741 one-cwt. bags, which is a figure equal to the largest weekly output during the national coal strike of 1912. It is our intention to distribute similar card folders as we did last year. These are to be sent out shortly after Christmas.

As previously mentioned, we invite customers to give standing orders for coke, instead of their having to send separate orders from time to time. We have no objection to accepting somewhat irregular instructions such as "every alternate Tuesday," "every second Thursday in each month," "every first of the month," &c. No confusion or difficulty need be experienced when dealing with such orders if a card index "tickler" (or reminder index) be intelligently used.

We are supplying about 15 per cent. of the householders with coke. What about the remaining 85 per cent.? Cannot we do something further to wrench some of this 85 per cent. from their rigid allegiance to coal? In Bradford we have made some local effort. There are other advertising methods which could with advantage be considered by gas undertakings—for example, personal canvassing, poster advertising, tram car and tram ticket advertising, slides for music hall picture screens, advertisements in newspapers, programmes, and parish magazines, advertisements on gas accounts, literature for placing on the counters of offices, and literature for distribution by meter inspectors and other gas department employees.

The *crux* of the whole matter seems to be that coke should be advertised persistently year in and year out, whether one has large stocks or small stocks. It would appear that, provided the quality is all that it should be, and the price reasonable, a satisfactory permanent local demand can only be built-up in this way. Do gas undertakings always realize that a few pounds spent in introducing coke may be a profitable investment, whereas scores of pounds spent in labour employed in stacking coke for which there is no immediate market bring in no return whatever? If the price of coke is reduced, what means are usually adopted to make the fact widely known? A newspaper advertisement for one or two insertions is not sufficient of itself, for it takes a great deal of publicity to bring home to many householders a fact like a reduction in the price of coke—a morsel of information in which they will not take much interest unless they are already users. Householders are very stubborn and conservative towards an article or commodity they are not accustomed to use regularly, and they can only be made to see the error of their ways when attacked on all sides by the sharp arrows of good publicity.

In conclusion, members will kindly understand that the views herein expressed are those of the writer, and not necessarily those of the undertaking with which he is connected.

Mr. Charles Roper enlarged on another aspect of the sale of the same commodity in a paper on

COKE FOR DOMESTIC USE.

As Mr. Broughton has so ably dealt with the publicity side of this subject, I propose to give an account of the manner in which the Bradford Corporation Gas Department deals with this trade.

The preparation of gas coke for domestic use in Bradford was commenced in January, 1902, the first week's sale amounting to 5 tons, which was gradually increased to 55 tons in the sixth week. The demand continued to grow, until in the December following 240 tons per week were sold, and the total for the year amounted to 2200 tons. Since that time the yearly sales have largely increased. In 1913 over 11,000 tons of broken coke were sold.

At first, when only a very small quantity was sold, the coke was broken by hand, by means of a crusher somewhat like a short double-handed pounder. The base was composed of a piece of $\frac{5}{16}$-inch iron 10 inches square, studded with spikes screwed and riveted at 2-inch centres, these being made of $\frac{3}{4}$-inch round iron, and $2\frac{1}{2}$ inches in length. This method was, of course, very costly, and as the demand increased machines were substituted. We have two types of machines in use. In one type the coke is broken between two rollers made in segments in the form of a spiral cutter. Only one roller is driven, the other being free; but in use we find trouble is caused by the coke clogging between the roller ends and the sides of the hopper. In the other type, the coke is broken between two cast-iron rollers studded with cast-steel teeth. In this machine, both rollers are driven and revolve towards the centre. These machines break from 20 to 30 tons per working day; but in busy times we find it necessary to run them night and day. To anyone interested in this trade, consultation of makers' lists shows that machines can be obtained suitable for small concerns as well as for large works.

At the Thornton Road works, where a modern coke-handling plant was erected in connection with the vertical retort installation, this class of coke is obtained direct from the screens, which grade the coke very well, and mechanical breaking is not necessary. In busy times here, the demand overtakes the available supply from the screens, and the large coke has to be drawn from the hoppers and carted to the breaker in the usual way.

Owing to the hard wear experienced, it is essential that strong sacks should be used; and we get the most wear out of a tarred hemp sack holding 1 cwt., size 45 in. by 27 in. These sacks have "B.C.G.W." sewn on one side, and are provided with two rope handles for lifting when filled. In addition, two small iron hooks or rings are fastened on opposite sides of the mouth, by means of which the bag is hung on to the filling hopper, and which prove handy when loading the sacks on the carts. To fill the sacks, a sheet-iron hopper, supported on three wrought-iron legs, is used, on to which the sacks are hooked and held in position for filling. The broken coke is then filled by 18-prong forks; these being rather finer than the ordinary coke fork. When the sack is full, it is released from the hopper by a small "knocking-off" lever, and is wheeled on a sack cart to the weighing scale.

Each sack is provided with a metal tag, on which is stamped its tare weight; and as the sacks do not vary above 3 to 4 lbs., excess weight is allowed to cover the heaviest. In addition to weighing each sack in this way, the loads are checked over the weighbridge on leaving the works. It is essential that care should be taken to give correct weight, as the sale of coke in this way brings the undertaking more under the view of the Weights and Measures Inspector. Further, the carters cannot "cry" the coke for sale in the streets without a hawker's licence.

Receipt tickets are provided for each sack of coke; the current price being stamped on in coloured ink, together with the usual date stamp. Owing to the hilly nature of the district, it is not practicable to send out heavy loads; 28 sacks being about the maximum. The journeys are arranged so that orders for neighbouring streets are sent out together; thus delivering the coke as economically as possible. Delivery sheets are given to the carters; and any orders not delivered, owing to the occupiers not being at home, are brought forward for the next journey to that district, and a printed notice is left at the house. As a rule, very few sacks are brought back full, as neighbours usually are eager to buy any which are not disposed of. It is not advisable to

leave the sacks on customers' premises, as, besides the trouble of keeping a record of them, such a practice means the locking-up of a number of sacks which cannot be spared—especially at busy times like the present, when over 1800 sacks are in constant use. Systematic repairs to the sacks are necessary owing to the heavy wear and tear. This is done by old employees, for whom useful work is thus provided.

Following the practice of some undertakings, the supply of this coke in paper bags was commenced some time ago, but with very little success; there being no actual demand, except in one district. The bags are not sold by weight; but the usual quantity is about 28 lbs. for 2d. About 400 bags are disposed of per week.

The price at which the broken coke is sold is 3s. 4d. per ton above the yard price for ordinary coke; this being reckoned as 1s. 8d. per ton for breaking, and 1s. 8d. per ton for delivery within one mile of the works. For districts outside this area, an additional 1s. 8d. per ton is charged.

When considering breaking coke for this class of trade, it must be remembered that the actual cost, whether broken by hand or machine, should not be the deciding factor, as in most gas-works (and particularly so with small undertakings, where storage room is scarce and capital expenditure on mechanical plant not advisable), the cost of throwing up the coke in quiet times, or (as often occurs) the absolute necessity of clearing the yard at low prices, involves points to consider when calculating actual costs.

The amount of breeze produced in coke breaking depends in part on the class of coal carbonized; and as we use a fairly large proportion of local coal, which produces a friable coke, the breeze percentage is perhaps rather high. Tests which I carried out some little time ago at the Mill Street works showed that the breeze made by ordinary tipping in the yard was about 7 per cent., and the breeze from the breaker screen 10·6 per cent.—making a total of 17·6 per cent.

As the quantity of broken coke sold in Bradford represents about 12 per cent. of the total output, it will be seen that the creation of local trade by means of coke breaking is well worth while. At the same time, it should be stated that the whole of this quantity is not new trade, as a small proportion of the coke is taken by old customers, who are satisfied to pay the extra price by reason of the increased usefulness of this small fuel.

DISCUSSION.

Mr. J. B. Balmforth (Silsden), in opening the discussion on both papers, asked whether, in the delivery of coke in Bradford, under the system described by Mr. Roper, any inquiries were made in regard to the character of the household customers, and their ability or willingness to pay.

Mr. Roper replied that the household trade was for cash only. The money was paid to the carter, and, in order to avoid confusion in dealing with both carters and customers, no money was accepted when orders were given. The carter had to bring back money for the coke taken out.

The President said he remembered that in Sheffield coke used to be hawked by men in the street, who sold it by the bucket. The first thing they did on getting a new bucket was to kick up the bottom and bulge in the sides, and this made an appreciable difference on the turnover at the end of the day. Unfortunately for the seller, this could not be done with tarred bags.

The Secretary (Mr. Edward Garsed) asked if Mr. Boughton could give any figures as to the net return from the coke output in Bradford in twelve months since the undertaking of the house-to-house delivery, as compared with ordinary coke sales previously. At Elland, within the past three months the Gas Company had purchased the chassis of a motor-car and converted it into a motor lorry, and had reduced their coke stocks from about 1500 to 1300 tons. If the carters could be induced, by a reasonable reduction of yard charges, to undertake the hawking of the coke, it might avoid any unnecessary outlay in cartage on the part of the gas undertaking. In one place he knew, a reduction of 1s. 6d. per ton was being made as a trial; and there was every hope that by this means the undertaking would get rid of what would otherwise be an inconvenient surplus.

Mr. Boughton replied that he was sorry to say he had not at hand definite figures to satisfy Mr. Garsed's request. Even if he had them he did not think they would prove anything, because in the period preceding the special campaign at Bradford they had had a regular weekly decrease which had to be wiped out; so he could not see that the relative figures would serve any purpose. In regard to Mr. Garsed's suggestion as to carting, unfortunately in Bradford the Corporation had decreed that all carting must be done by the Municipal Team Labour Department. He was not prepared to express any opinion as to the economics of the question, but this was the position.

Mr. Balmforth said he had recently put to one whom he supposed to be an authority the question as to whether it was necessary, in compliance with the law, that there should be a scale on the carts taking round coke, as in the case of coal; and he had been assured that it was necessary, and that the purchaser had the right, if wishful, to see it weighed.

Mr. Roper said, so far as he was aware, it was not compulsory. At the same time, if they were selling by weight it was necessary that they should give proper weight. He believed some undertakings sold coke by the bag, without any statement of weight. It had, however, occurred in Bradford that the carts had been stopped and the bags been weighed by the Weights and Measures Inspectors.

Mr. C. D. Cawthra (Halifax) said it would be valuable to have a legal opinion on this point. The Act was somewhat ambiguous. At Halifax it was the practice to sell coke by the bag and not by weight. As a matter of fact, the bags weighed usually a little over 1 cwt., though there was a possibility of them being less. A point which had struck him in regard to Mr. Roper's paper was that no mention was made of the sale of broken coke in loads and of large coke in bags.

Mr. Roper said in Bradford broken coke was sold in loads at the full price, and ordinary coke was supplied in bags to such places as schools and institutions where they had no means of shooting the coke in; and, where necessary, a charge was made for an extra man to help in carrying the bags in. In regard to motor carriage, it had not been tried in Bradford. He feared that motor-waggons would be awkwardly placed in some of the narrow, hilly back streets of the city. If the scales on carts were made compulsory, he saw signs of some good trade for some scale-maker in Bradford. His department had the previous day sent out 35 carts carrying broken coke, and none of them had scales.

Mr. G. H. Walker (Elland) said he happened to come from the place where they had a motor lorry. The Elland motor made about seven journeys a day, taking out 20 bags per load. Since the inauguration of the service three months ago they had taken 1200 orders. In answer to a query by Mr. Boughton, he was not counting many repeat orders in the figure.

Mr. Boughton remarked that in Bradford they had repeat orders coming within a fortnight of the first order.

Mr. Walker said he thought the papers had not mentioned anything about the net price of coke per bag. Their carters had orders to leave no coke unless they obtained payment. But some people were very cute. They allowed the carter to get the coke in the cellar while they went to find the money; and when the coke was safely in they discovered they had no money handy. How did Bradford do in regard to people who were always out, but left instructions for the coke to be delivered? Did the carters take any extra supply of bags to meet the sudden calls of people who had not had delivery?

Mr. Roper said the yard price in Bradford was 10s. With regard to people who were out, they did not get their coke unless they left the money next door. In slack times some extra bags had been taken in case of calls by people who had been out on the occasion of the previous visit of the carter; but this was not done in busy times. The men, however, could not cry the coke or hawk it without a licence. The carts, as a rule, made three journeys a day, and took 28 bags at a time. He made no comment on the sufficiency or otherwise of the number of journeys.

Mr. Cawthra said in Halifax they had been faced with the question of getting rid of a good deal of coke which had in normal times been shipped. Different methods had been tried; but in September last they tried a drastic idea. The price was 13s. 4d., and they advertised very widely that for a certain fortnight it would be reduced to 8s. per ton at the works. The result was that the output increased about three times above the normal, and even after the first rush. It had since then been much higher than in any previous year. Whether or not this would continue, it did, at any rate, serve the purpose of the moment.

Mr. Sutcliffe asked if, after the fortnight's sale, the price was put back to 13s. 4d.

Mr. Cawthra replied that it was; but during the past fortnight, in order to decrease the stock for Christmas, they had a sale at a reduced price of 10s. per ton. This had been very successful; but, of course, nothing like the rush of the first and more drastic one. Their experience had been that, if any reduction was to be made, it must be a big one.

Mr. Sutcliffe said he heard that when Halifax reduced its price, the surrounding undertakings reduced theirs for a month.

Mr. Cawthra said Halifax had certainly suffered by the competition of the surrounding district undertakings. They knew that during the sale people from outside were buying; but, of course, these had gone back to their own district undertakings.

The President, in bringing the discussion to a close, said it was evident that there was more in the sale of coke than some of them dreamed of.

The Bradford Corporation Gas Show-Rooms.

Mr. Sidney H. Packer, the Manager of the Bradford Corporation Gas Show-Rooms, then read a paper in which he described in detail the arrangements and contents of the show-rooms and the good results which had accrued since the opening of them. A full description of the show-rooms, with illustrations, appeared in the "Journal" for Oct. 6 last (p. 39). Mr. Packer said that a further development of pubicity was to be made for the Christmas season; and in the first week in January, in conformity with the decision to make the window displays a changing exhibition of specialities which would attract public attention and admiration, a special café and restaurant appliance demonstration was to be organized, and the windows would be set out as a modern café. Builders and architects were shortly to receive special attention on the part of the staff. During the ten weeks the place had been opened they had sent out 527 fires and 264 cookers, as against 213 fires and 110 cookers for the corresponding period of the previous year.

A hearty vote of thanks was accorded the readers of papers and to the Gas Committee and staff for the use of the rooms.

Mr. Roper having briefly responded, the members dispersed for the purpose of a personal examination of the exhibits.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Capital Raising by Statutory Gas Companies.

SIR,—We had not intended trespassing further on your space; but, as you invite us to do so, we offer (with all diffidence) the following reply to Mr. Herring's letter.

Mr. Herring appears to consider that profits should be the basis of any further enlarged borrowing power. We are afraid that this would be unworkable. There would be no constant and definite borrowing power, as it would vary up and down according to the amount of profits.

Apply this method of borrowing to companies who have sustained heavy loss of business since August last, and it will become apparent at once that the security that the Directors could offer next year would be less than that which they were able to offer this year.

Supposing this happened at some future time to a Company who had borrowed "up to the hilt" relatively to its profits, and to whom it was essential to raise further capital in some form? It would be bad enough if such a necessity arose in normal times, but what if it happened in such a period as many think we have before us?

However, we are in complete accord with the principle of Mr. Herring's suggestion that there is ample margin for enlarged borrowing powers by gas companies. While, so far as we can see, there is no objection in principle to this being allowed, there are obvious advantages, both to the shareholder and the consumer—especially the latter, who takes under the sliding-scale so much larger a share of any benefits conferred upon the company.

But surely it would be better that any increased borrowing power should be fixed in amount, or proportion, in relation to the paid-up capital. You would then have a definite borrowing power, easily ascertainable by reference to the company's last Act, instead of the fluctuating powers under Mr. Herring's proposal.

As a matter of fact, we are, ourselves, promoting in the ensuing session a Bill in which we are taking enlarged borrowing powers for a company. But the power bears a definite relation to the paid-up ordinary capital of the company; and at the proper time we shall justify the proportion asked for by reference to the profits of the Company.

The adoption of Mr. Herring's proposal, in principle, would not necessarily shut out ours. In fact, it could form part of the process of making gas shares more attractive as an investment.

All the money wanted would be forthcoming if the investment were sufficiently attractive. At the present moment it is not; nor is it likely to be. Obviously, the more attractive to the investor one makes the capital, the better it is for the consumer.

The incidence of the sliding-scale is too harsh in these times against the shareholder. The value of the sovereign is not what it was when the sliding-scale was originally established; nor, in our view, in the lifetime of any man now living is money ever likely to return to its former value.

Moreover, with the burden of ever-increasing rates and taxes, and the cost of material and labour mounting upward and ever upward, clever gas managers have no prospect of adequate return for the exercise of their ability and resourcefulness while matters remain as they are just now.

At the present moment, we are faced with the fact that the maximum dividend company offers the greater attraction to gas investors. It would be a bad day for gas consumers if this advantage should become more emphasized, because legislation refuses to adapt its outlook to the altered conditions, and now, in our opinion, is the psychological moment for putting the matter to the test.

R. W. COOPER AND SONS.

5, *Victoria Street, S.W., Dec.* 17, 1914.

Calorific Value: What is it Worth?—Reply to a Critic.

SIR,—When writing to the "JOURNAL" three months ago, calling attention to certain aspects of calorific value, and making deductions therefrom, I expected to be criticized. But it was confidently expected that the critic would take the proper course of understanding the subject-matter of the communications and the questions involved. Mr. Norton H. Humphrys has done neither. This does not show the practical-mindedness of the famous camel-driver prophet Mahomet, one of whose clever sayings one might quote here—"Trust in heaven, but tie up your camel."

In pointing out that calorific value was not a real measure of value to the consumer, and submitting a fairly reasonable argument in favour of the general proposition—that there is a pressure of supply at which the lower calorific gas is of equal worth to the higher calorific gas, and that above this pressure the lower calorific gas is of most worth—the idea was to induce the industry to forsake the policy of "drift," and undertake a scientific research into the important question of a standard of supply. Important to the shareholder, because it is by no means certain that the present supply is one that can yield him the largest return; and to the consumer, because it is equally uncertain that he is getting maximum value for money. In other words, it was advocated that the industry should "tie up its camel."

Even this position is attacked. We are asked: "If the figures reported by Mr. Forshaw are to be rejected as unreliable, what is the use of research at all, and why talk of further research?" One would have thought that the question answered itself. But if not, let Mr. Humphrys supply his own answer, remembering that Mr. Forshaw worked only upon elementary gases, carbonic oxide and hydrogen, and not the complex mixture of gases found in coal gas. His own words are: "I am free to confess that the behaviour of mixed gases under combustion, as compared with that of the various constituents taken separately, is an open subject." Placing it no higher than this, and ignoring the further reasons advanced in the "JOURNAL" for Oct. 20 (p. 136), is this not sufficient? But I leave the point with the simple remark that it is strange that an attack should in any way be based upon "an open subject."

Mr. Humphrys further says: "There may be the magnificent flourish of the right arm, but things remain as they were; and the point is not the base of my remarks, but their correctness or otherwise, and whether they are germane to the matter under discussion. This is a matter that I am content to leave to the judgment of any reader who can record some experience with distribution with high pressure." I accept this position, so far as my understanding of it goes. It is not desired that any point should be skirked. I propose therefore to take Mr. Humphrys' specific questions and assertions, and to supply answers. At the same time, I am free to admit that, even supposing Mr. Humphrys be proved wrong, the proposition is not necessarily proved to be right. Only the results of a trial will do this. I hope to have the privilege of submitting these at a later date.

Mr. Humphrys: I have yet to learn that a burner complying with the conditions of complete aëration before combustion has been constructed. The extent of supply pressure to produce such a desirable result is equally in a nebulous state.

Answer: While it is difficult to understand the reason for the second assertion in view of the first, the experience of those who have investigated this matter is that in ordinary moderately good burners with present supplies at pressures ranging round 8 inches of water, there is a sufficient margin not only to get the right mixture, but also the flame shaping itself to the mantle. Air-sleeves are necessities of burners under these conditions.

Mr. Humphrys: A pressure of 10 inches at the burner has been mentioned for the purpose of argument, possibly on the assumption that if 50 per cent. of the air is drawn in through the air-holes of a bunsen burner at 25-10ths pressure, 100 per cent. would take four times this figure.

Answer: No such assumption was made. The deduction from such an assumption is wrong. There is nothing in the articles about 10 inches at the burner.

Mr. Humphrys: I take it that the object of suggesting complete aëration is because such a condition is regarded as the *ne plus ultra* of combustion, as the point at which the mantle would show the highest duty. If this can be assured at 10 inches, what is the use of higher pressures? We have heard very much lately about high-pressure burners at 50 to 60 inches pressure; but what is the benefit of such high pressures if the zenith is reached at 10 inches? In this connection it would be interesting to know the proportion of air mixed with the gas previous to combustion in a 60-inch pressure burner.

Answer: The point of complete aëration, even supposing this to be assured with a pressure of 10 inches, is not the point of highest duty. It is simply the point at which the flame does not lose in intensity by reason of its having to draw from the extraneous atmosphere for the completion of its air supplies. My suggestion was that at this point the lower calorific gas is not placed at a disadvantage in comparison. Of course, it might be possible that exactly the same result be obtained at a pressure securing just less than the complete aëration. Experiments made under conditions where turbulence is at the minimum seem to show that the point of maximum velocity of ignition is in the mixture with aëration just less than the amount of complete combustion. There is, however, very little in it. Above the pressure to secure complete aëration, better results are obtained in illumination of the mantle, by a further contraction in flame bulk for a given amount of gas consumed. This is brought about by the mechanical conditions of the burner and the results of increased turbulence with the higher velocities. The eddying motion—as the result of the rapid inrush of both gas and air, where one injects the other and the progress of both is somewhat impeded—produces an increased velocity of ignition. It wants very little understanding to see that the conditions below complete aëration are widely different from those above. There is turbulence in both cases; the effect of it is different. In the one case it acts as a drag; in the other as a help. There is much in common between the gas-engine and the gas-burner; and if Mr. Humphrys has not noticed the work of Mr. Dugald Clerk, or even the lectures of Professor Hopkinson before the Royal Institution last year, and which were faithfully recorded in the "JOURNAL," he should look them up. Just as the results of any bunsen burner would be impossible without turbulence, it was clearly demonstrated that speeds in a gas-engine of more than a tenth of those obtained would be likewise impossible. The proportion of air mixed with gas prior to combustion in a 60-inch pressure burner would not be far short of that securing complete aëration—in fact, as near to it as shaping the flame to the mantle would allow by the manipulation of the air sleeves.

Mr. Humphrys: According to Mr. Fairweather, the gas of highest hydrogen content—pure coal gas—should give the highest duty. But it was found that coal gas, which would contain over 50 per cent., only gave 25½ candles per cubic foot; while carburetted water gas, which would not exceed 40 per cent., gave 33 candles. This does not go to show that hydrogen is the best friend to consumers.

Answer: No such thing was said. The results are entirely in accord with those to be expected. What was said was that hydrogen accounted for exactly this condition of things, when the pressure of supply was less than that to place both gases upon equal terms in the amount of air for combustion to be extracted from the extraneous atmosphere. Under conditions of excess pressure, hydrogen shows itself as a friend to consumers.

Mr. Humphrys: Mr. Forshaw's paper is (so far as I am aware) the nearest published approach to complete aëration, which is the principal plank of his (Mr. Fairweather's) platform. Mr. Forshaw managed to get 80 per cent. in the case of hydrogen and 76 per cent. in the case of carbonic oxide—a result which put the two gases on fairly even terms, and is sufficient approach to complete aëration to be quoted as indirect evidence, &c.

Answer: The statement is wrong in every detail. Does not Mr. Humphrys understand something of burner construction? Why does he ignore the fact that the quoted results were obtained in two different burners, and, in the case of hydrogen, with what might be called a water-cooled explosion trap?

The only real point Mr. Humphrys has raised is one secondary to the proposition, but one involving its practical application—the

possibility of materially increasing on the present pressures of supply. The limitation in immediate big increases has been freely admitted. Anything like the pressure Mr. Humphrys has in mind is not contemplated to-day or to-morrow. But exchanges could be made—British thermal units for inches of water—immediately, so far as conditions allow; and, in my opinion, it would have a beneficial effect upon high-pressure lighting, and not hurt efficiency in other uses of gas. The changes made during the ordinary periods of renewals would make further increases possible. What I certainly do say is that a supply of 475 B.Th.U. gas at a pressure of 10 inches on the main would be of more value to the great bulk of consumers than the present supplies at the present supply pressures.

The older theories on the cause of luminosity in the flat-flame have been mentioned. I have one which, so far as I know, has not been advanced. I have long noticed that the illuminating constituents are "endothermic." Endothermic compounds readily decompose. When they do so, heat is evolved. Thus, when acetylene is split up into carbon and hydrogen, while the elements are still unconsumed, the matter of 250 B.Th.U. per cubic foot of gas are liberated; with ethylene, 40 B.Th.U. Carbon monoxide, methane, and ethane are exothermic—they absorb heat in being decomposed into their constituent parts.

It has seemed to me that the extent of the illumination of gas in the flat-flame is to be explained by the fact that heat is liberated in the flame at the exact spot where each particle of carbon is liberated. The particles of carbon are consequently heated to a point of incandescence corresponding to a temperature greatly in excess of the average temperature of the flame.

Dec. 16, 1914. J. H. FAIRWEATHER.

Current Sales of Gas Products.

SIR,—Adverting to a letter you received from a "Lancashire Tar Distiller," under date of Dec. 9 [*ante*, p. 627], with respect to the price of pitch, I must confess that I was surprised to hear that pitch was being sold in the North at about 20s. per ton. But it has come to my notice, since reading the "JOURNAL" on Wednesday last, that attempts are being made to force the price down to even less than 20s. per ton for prompt delivery. Further, I know at least one tar distiller who is offering pitch for delivery over the whole of next year at about 24s. per ton.

Is it not time for those responsible for the management of gas undertakings to take a firm stand with regard to the disposal and prices of pitch during the present crisis? If they are willing to allow payment of the so-called pitch proportion of their accounts to stand over for the time being, the tar distillers ought to willingly agree to allow the pitch to stand in stock at their works until it can be disposed of at a fair price.

Surely there can be no real justification to force the price down to 20s. per ton at works.

Perhaps someone will be good enough to publish in your columns the reason why members of the Joint Committee representing tar distillers and tar producers were unable to agree upon a minimum price for pitch.

Dec. 19, 1914. MIDLAND TAR DISTILLER.

Mr. Halkett's Yorkshire Junior Gas Association Paper.

SIR,—Might I be allowed a few words of comment on the paper read by Mr. R. Halkett to the Yorkshire Junior Gas Association at Leeds, on Saturday, the 5th inst.

There is only one point of interest in the paper, and that is the "card system." The claims put forward by Mr. Halkett on behalf of this system should be carefully considered by any one before attempting to put it into practice.

The "card system" replaced one called the "duplicate system," which was inaugurated on June 1, 1912 (in the middle of the busiest season in the history of the department); and in one month the system had brought the department out of a state of chaos into which it had been thrown by the introduction of free stoves, the advent of which those in high authority had made no provision for (hence the complaints, dating from April, of which Mr. Halkett speaks).

The "duplicate system" was based on practical experience of the distribution department. The work of the clerical staff was reduced, and the clerical work done by the foremen was also considerably reduced. After twelve months' good work, the "duplicate system" had justified its existence in every detail; but on May 31, 1913, without a word of comment or inquiry of its author, the system was thrown into the waste-paper basket as a "scrap of paper."

On June 1, 1913, the "card system" was instituted, on a clear footing—no back-orders being on hand. But notwithstanding this fact, the clerical staff had to be almost doubled, and the clerical work done by the foremen trebled, without a corresponding increase of output.

I have now the experience of twelve months of each of the systems before me; and the result is by no means in favour of the "card system."

It is thought by some people not to be loyal to one's superiors to criticize their methods; but it is more disloyal to think the methods of one's superiors wrong and not criticize—especially when these methods appear in the Public Press.

It would take up too much of your space to enter into details of the "duplicate system;" but these might be had if you think it worth the trouble.

RICHARD LIGGETT, Secretary,
Foremen's Association, Gas Department.

Glasgow, Dec. 11, 1914.

Evans on Purification by Heat.

With reference to our leading article on this subject in last week's "JOURNAL," p. 585, Mr. W. J. A. Butterfield writes to point out that, in our comments on his remarks in the discussion on Mr. Evans's paper, the washing process for the removal of sulphur was not by the use of "alkali," but of "alcohol." He referred to the process merely as one which ought to remove thiophene as well as carbon bisulphide from the gas; he did not suggest that, from the commercial standpoint, it could compete with Mr. Evans's process. He thinks it would only become commercially practicable if partial recovery of benzol from gas were aimed at, in addition to the extraction of sulphur compounds; and even in that case, the Excise requirements as to the control of the operations might interfere with its adoption in this country. The process was described in the "JOURNAL" for Nov. 25, 1913, p. 666.

REGISTER OF PATENTS.

Water-Gas Production.

PICTET, R. P., of Wilmersdorf, Berlin.

No. 24,374; Oct. 27, 1913.

This invention relates to the production of a pure water gas—*i.e.*, a mixture of carbon monoxide and hydrogen; the chief object aimed at being "to provide a continuous process in which the greatest economy of material and heat energy is obtained."

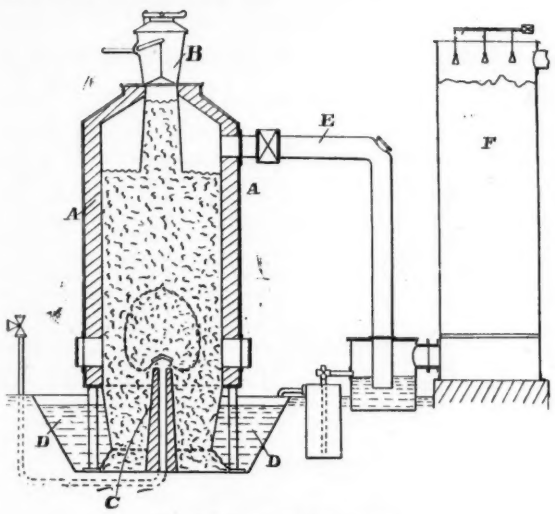
As is pointed out by the patentee, the ordinary method of producing water gas is an intermittent one; air being admitted to a generator containing the heated coke or anthracite, in order to raise its temperature to such a level (approximately 1600° C.) that, on shutting off the air and passing steam through the fuel in the opposite direction, the steam is broken-up into hydrogen and oxygen. The latter combines with the highly-heated carbon to form carbon monoxide, which, together with the hydrogen, passes through a scrubber to a gasholder. The steam reaction absorbs a large amount of heat—58 calories per gramme molecule (18 grammes) of water, producing 16 grammes of oxygen. The oxygen combines with 12 grammes of carbon to form 28 grammes of carbon monoxide, producing 26 calories—leaving a net loss of 58 – 26 = 32 calories of heat. The fuel thus soon falls in temperature to a point at which the steam must be cut off, and a fresh supply of air admitted for reheating purposes. The heat is obtained on the admission of air chiefly by the formation of carbon dioxide—the result of complete combustion of carbon; and this, together with the nitrogen forming the bulk of the air, passes into the flue in a hot state—thus wasting a large quantity of heat. A substantial quantity of carbon monoxide is also formed, which may also be wasted; or, in large installations, the gases obtained during the reheating reaction may be employed for heating boilers or in internal combustion engines, by which the heat available in the gases of calorific value (carbon monoxide) may be partly recovered. This is, however, only possible in large installations, he mentions, and "by means requiring expensive supervision." Moreover, in the steam reaction the liberated oxygen forms a certain quantity of carbon dioxide, which mixes with the water gas as an impurity. The proportion of carbon dioxide increases rapidly with the fall in temperature of the fuel, which may drop to about 1000° C.; so that the reheating operation has to be started again after only a moderate cooling of the heated fuel if fairly pure water gas is required. A further source of waste lies in the fact that, to avoid dilution of the water gas with the nitrogen and carbon dioxide in the generator at the end of the heating operation, a considerable amount of water gas must be wasted in displacing the waste gases in the generator.

According to the present invention, pure, or nearly pure, oxygen is admitted in intimate mixture with the steam, in such proportions as to maintain the fuel continuously at the temperature necessary for efficient action—this temperature being from 1500° to 1800° C. (preferably, approximately, 1600° C.), as at this temperature less than 0·2 per cent. of CO_2 is found in the water gas. A mixture of steam and oxygen has already been proposed for the continuous production of water gas and of bye-products; but the conditions necessary for obtaining a pure water gas have not previously been realized—the chief condition being the continuous maintenance of the high temperature above referred to, in order that the desired reactions may be practically complete. By a process forming the subject of patent No. 9357 of 1913, the inventor claims to be able to obtain oxygen at very low cost; and this oxygen can therefore "be used in the water-gas generator to produce economically a combustible gas of high efficiency." Since the oxygen and steam are admitted together in carefully regulated proportions, the reduction of temperature at any point of the fuel, which would have occurred owing to the dissociation of the water molecules, is immediately compensated for at the same point by the partial combustion of the fuel to carbon monoxide by the excess oxygen present. There is, therefore, no actual fall in temperature if the proportions of oxygen and steam are carefully regulated. As has been already explained, there is a deficit of 32 calories of heat to be supplied for each 18 grammes of steam dissociated; and as each gramme molecule (16 grammes) of oxygen gives 26 calories by the formation of carbon monoxide, 19·7 grammes of oxygen are necessary for thermal equilibrium.

The following figures given in the specification show the amount of heat absorbed by, and supplied for, the various reactions, and the proportions of the oxygen and water required: Taking 1 kilo. of water in the form of steam as the standard quantity (55·56 gramme molecules of H_2O), the heat absorbed in dissociating this amount into hydrogen and oxygen is 3233 (55·56 × 58·2) calories; and the yield in gas is 1244 litres of hydrogen and 622 litres of oxygen. The hydrogen remains unchanged in the mass of fuel, at (say) 1600° C.; but the oxygen combining with the carbon gives 1244 litres of carbon monoxide. The latter reaction at 1600° C. generates 1450 (55·56 × 26·1) calories of heat; so that there is a net loss of heat of 3233 – 1450 = 1783 calories. The amount of excess oxygen necessary to generate this quantity of heat by the formation of carbon monoxide is 764 litres—giving 1528 litres of the monoxide. The total carbon consumed by the added oxygen and the oxygen derived from the water is approximately 1486 grammes (666·72 grammes burnt by oxygen from the water and 819·6 grammes by added oxygen); and the volume of gases obtained is: hydrogen, 1244 litres and carbon monoxide 2772 (1244 + 1528) litres = 4016 litres in all. The total heat of combustion of this quantity of pure water gas is 11,740 calories; 1244 litres of hydrogen giving 3233 calories, and 2772 litres of carbon monoxide 8507 calories. A kilogramme of carbon would

therefore yield an amount of gas giving approximately 7895 calories. One cubic metre of this gas would yield about 2923 calories. An allowance of 10 per cent. may be made for heat losses due to radiation, and the amount of oxygen supplied and carbon consumed will, for an actual apparatus, have to be correspondingly increased over the figures given above, which represent ideal conditions—resulting, of course, in an increased quantity of carbon monoxide in the water gas. The increased carbon monoxide would amount to about 280 litres (for each kilogramme of water used); making a total gas production of 4296 litres, with a calorific value of about 12,600 calories. The calorific value of the gas obtained per kilogramme of carbon consumed remains practically the same—approximately 7895 calories.

As compared with the discontinuous process, and the continuous air and water process, the calorific value of the gas obtained per unit of carbon consumed is said to be between two and three times the value of that resulting from the discontinuous process (which produces a rich gas) and substantially greater even than that of the old continuous process, which produces a relatively large volume of a poor gas. The new process is claimed to give a rich gas in much larger quantity than is obtained by the discontinuous process, but of little more than half the volume of the gas produced by the Mond process, owing chiefly to the elimination of nitrogen.



Pictet's Water-Gas Generator.

The accompanying illustration is a diagram (partly in section and partly in elevation) of apparatus suitable for carrying out the process referred to.

A is the generator, constructed (as usual) with an outer sheet metal cylinder and a lining of highly refractory bricks of silica, alumina, carborundum, or such like material, so as to protect the metal walls from the heat and reduce to a minimum the loss by radiation. The generator is filled with coke through a double-valved hopper B; and the ash can be discharged at the bottom of the generator. C is a vertical tube of silica, carborundum, or other refractory material projecting into the lower part of the generator aud supplied with an intimate mixture of steam and oxygen through the pipe at the side having steam and oxygen inlets and discharging through orifices at the upper end of the tube C. D is a water seal for the bottom of the generator. E is a pipe leading the water gas to the scrubber F, whence it passes to a gasholder.

The coke is ignited as usual, and, as soon as the fire has been started, an abundant current of oxygen, with but little steam, is allowed to enter—raising the coke rapidly to a high temperature throughout the centre of the generator. Steam is added progressively to the oxygen until the standard mixture (as given above) is reached, and the gases pass into the scrubber F filled with coke, to which water is supplied through sprinklers. The cooled and scrubbed water gas then passes to the storage holder.

To ensure good results, the following conditions should, it is said, be complied with: The coke extends for a height of from 1 to 1½ metres above the steam and oxygen supply, so that the steam may be entirely decomposed. The temperature of the coke through its entire height should be raised to 1600° C. before the normal proportion of steam is admitted—that is, the maximum amount compatible with the maintenance of this temperature. The diameter of the generator must not be too great, as if the temperature of the coke at the periphery should fall, part of the steam might pass through without decomposition, and the water gas would then contain carbon dioxide. The height of the coke should be regulated and kept constant as far as possible.

Incandescent Gas-Fittings.

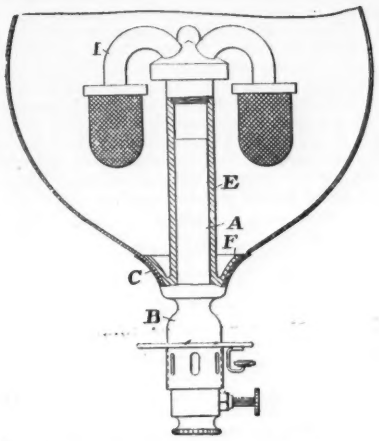
ROBIN, J. I., of Great Titchfield Street, W.

No. 27,331; Nov. 27, 1913.

This invention consists in an incandescent gas-fitting adapted for inverted mantles and having means for mounting in position a globe or like protector closed below the mantles.

The fitting is made in two parts, one of which A is secured to, or formed in one with, the mixing-chamber B and with an external flange C to support the globe, while the other part E carries an internal flange or support F for the globe and a fitting for the gas-mantles.

In the example illustrated, the fitting is similar to that described in patent No. 16,487 of 1912, with the exception that the tubes I are bent backwards upon themselves; so that while the fitting assumes an upright position the mantles are in the inverted position. When it is required to assemble the parts in position the globe is mounted upon



Robin's Incandescent Gas-Burner Fitting.

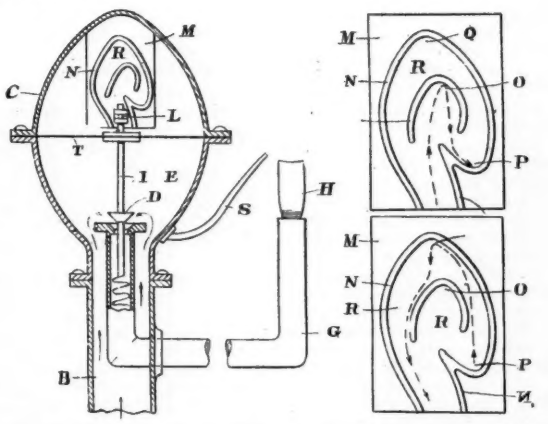
the support C, whereupon the fitting E, with the mantle fitting above, is secured thereto by screwing, or otherwise is pushed upon the tubular part of the fitting A, so that the globe is held firmly between C and F, and the whole device is ready for use.

Automatically Lighting and Extinguishing Gas-Lights.

OXSPRING, R., of Wadsley Bridge, Sheffield.

No. 28,780; Dec. 13, 1913.

This device is to be used in conjunction with valves adapted to be opened and closed alternately by the application of pressure upon the gas supply.



Oxspring's Automatic Gas Lighting and Extinguishing Device.

An elevation (in section) is given of the device constructed with a diaphragm of flexible material; also an enlarged plan showing the course of the first movement of the valve finger and the same plan showing the return movement of the finger.

The apparatus consists of a casing, the lower part B of which is connected with the gas supply pipe and forms the inlet. The upper part C is a detachable cover; and the flexible diaphragm T is gripped between the peripheral edges, which are screwed together. The valve D below the diaphragm within the gas-chamber E is adapted to be raised from its seating, which forms the opening to the outlet pipe G communicating with the burner H. The lower part of the valve rod I is preferably provided with an extension below the valve (such as a short coil of wire) to act as a loosely fitting and pliable guide to the valve when closing; while the upper part of the rod is passed through, and secured to, the diaphragm, so as to be actuated by it in its rise and fall. Near the top end of the rod is a laterally projecting pin or finger L (held loosely between two collars), the extreme end of which is arranged to engage with a device to be described.

This device M is arranged within the upper part of C, and consists of a path R between the walls N along which the end of the finger is caused to travel as the diaphragm rises and falls. The pathway and walls may be made upon a metallic plate and the walls be made of wires soldered to it. The inner wall W forms a bend or loop at O, which is directly over an inclined wall leading into a pocket P; so that when the gas pressure is withdrawn the valve finger drops upon the incline below and slides down into the pocket, where it is retained and the valve held open. Upon the next impulse or wave of pressure being given, the valve is again raised, and the finger is also raised from P and guided upwards into the bend or corner Q, from which it will drop

when the pressure is removed) upon the back of the wall W and pass down to its normal position with a closed valve.

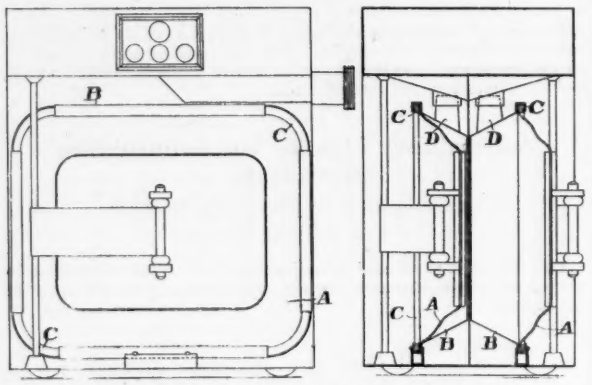
An important feature of the invention is said to be the construction of the walled pathway device (with its arrangement of bends and pockets) and its use, in combination with the valve pin, of "any suitable valve" by means of which at one application of pressure on the gas supply the valve is raised and retained in open position, and at the next impulse of pressure it is closed. This action is more particularly described as follows: The normal position of the valve being closed, pressure being put upon the gas the impulse raises the diaphragm, and the finger which strikes against the central wall is stopped in the loop O and drops into the pocket P, where it rests and keeps the valve open as long as is required. On a second impulse being given to the gas to close the valve, the finger is again raised and (guided by the outer wall) reaches the top Q, and, dropping against the inner wall, is guided down the path R, and so to its first position and destination. A bye-pass S supplies a pilot light to the burner H, as is usual.

Gas-Meters.

JAMES MILNE AND SON, LIMITED, FOX, T., and OLIVER, F. R., of Edinburgh.

No. 1737; Jan. 22, 1914.

This invention relates to gas-meters wherein diaphragms or bellows made of leather (or the like) are employed; and it has for its primary object "to facilitate the removal of such diaphragms or bellows and to dispense with the necessity for soldering operations in the vicinity of the edge of such diaphragms or bellows subsequent to the latter having been placed in position, in order to prevent injury."



Fox and Oliver's (Milne and Sons) Dry Gas-Meter.

An elevation is given of one form of the meter with the outside cover-plate removed; also a part section and elevation at right angles.

The diaphragms A are attached to the flange of a removable dish-like member B of the meter by a clamping frame C engaging the diaphragm adjacent to its edge and detachably secured to the flange by means of clips. The flange is of angular cross section, forming a rebate within which are accommodated the edge of the diaphragm and the clamping frame, while the clips are formed as channels adapted to embrace the flange and clamping frame.

The outline of the members B conforms approximately to the outline of the diaphragm chamber of the casing of the meter; being provided at one side with a communication pipe D having a conical end, adapted, on the placing of B into the casing, to enter a conical orifice communicating with the distributing ports of the controlling valve mechanism of the meter (not shown). The member B, after being subjected to a lateral pressure to force the conical end of the communication pipe D into engagement with the conical orifice, is secured in position within the casing by a U-shaped fastening clip placed over the flange of the member opposite to the side at which the communication pipe is provided. This fastening clip abuts against the casing of the meter, and is secured to the clip by tacks of solder applied at preferably two points.

By virtue of the removability of the member B carrying the flange serving for the attachment of the diaphragm, in conjunction with the provision of the clamping frame and clips, only a very small clearance between the edge of the flange and the walls of the casing of the meter is required. Thus the dimensions of the casing may be reduced to a minimum for a given meter capacity, while the diaphragm may be easily fixed in position without involving the necessity for soldering operations, save for the application and removal of the tacks of solder—an operation necessitating merely momentary applications of heat having no detrimental effect upon the diaphragm.

Flue Pipes of "Geyser" Water-Heaters.

RICHMOND GAS STOVE AND METER COMPANY, ST. LEGER, A. A. H., and PRATT, J. P., of Warrington.

No. 2162; Jan. 27, 1914.

The chief object of this invention is to provide improvements in connection with geyser flue pipes, whereby access can be readily had to the interior of the apparatus, without having to disturb the flue pipe.

The flue consists of two tubular parts, which telescope one into the other. The lower one is movable in relation to the other; and it fits sufficiently well to allow sliding motion. The outer tube has a movement limiting part such as an internal flange, which acts as a stop when the movable tube is pushed up.

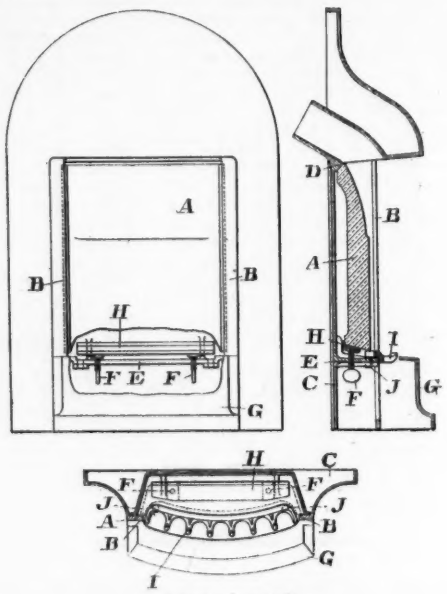
The effect of the arrangement is said to be that, when the flue is attached to any apparatus, no down-draught is caused; and at the same time any condensation is prevented from getting into the lower tube, and falls into a screen attached to, or forming part of, the upper tube. When the apparatus needs cleaning, and access to it is required, the lower and internal tube is telescoped up into the upper and external tube or funnel—thus leaving ample room above the apparatus for access to it.

Gas-Fires.

YATES, H. JAMES, of Aston, Birmingham.

No. 9174; April 11, 1914.

This invention (relating to gas-fires of the type in which a number of "radiants" are arranged in front of a fire-brick back; the object being to facilitate the securing or replacement of the brick) comprises the provision in the frame or body of the grate below the fire-brick of one or more screws or equivalent fastening devices, and the adaptation of the brick and the portion of the frame which receives the brick so that, when the fastening device is tightened, a combined vertical and lateral pressure is imposed upon the brick, causing it to fit tightly against the frame along its vertical front edges and to be secured against sideways movement.



Yates's Gas-Fire.

A part sectional front elevation, a sectional end elevation, and a sectional plan illustrating one application of this invention to a gas-fire are given.

The fire-brick back A is adapted (as heretofore) to fit tightly along its vertical front edges against a pair of vertical edges or surfaces B in the cast-iron frame or body C of the grate. At its upper end the rear of the fire-brick is chamfered and caused to abut against an equivalent portion D of the body. The brick is also preferably chamfered along its lower edge from front to back. Beneath the lower edge of the brick are inserted, through a transverse ledge or plate E in the frame, a pair of thumbscrews F, which can be operated from the front of the grate when the fender G is removed. Between the upper ends of the screws and the lower edge of the brick is a metal strip or plate H, which can rock on the ends of the screws.

Due to the configuration of the parts, the screws (when tightened) not only produce a vertical pressure on the brick, but also a lateral or outward pressure. By their action and the inclined abutment at the upper edge of the brick, the latter is forced tightly against the vertical faces mentioned above; and a tight joint is obtained, while the brick is securely held against sideways movement.

To withdraw the brick, it is simply necessary to slacken the screws, and the brick is then free to be withdrawn. This is effected by first imparting to the brick a sideways movement, which enables one edge of it to be disengaged from the frame, and thereupon permits the whole of the brick to be withdrawn. To cover the aperture between the lower edge of the brick and the ledge E which carries the tightening device, the tray or shelf I, which supports the radiants, may be utilized. The tray is provided with a pair of dowel pins J, which enter a pair of apertures in the ledge, and the latter is extended at both ends, or otherwise suitably shaped to support the ends of the tray. In this way the fire-brick back can be secured in position and removed at any time for replacement without disturbing any of the attachments of the fire.

Barrow-in-Furness Gas Undertaking.—Some discussion took place at the last monthly meeting of the Barrow-in-Furness Town Council respecting a recent partial failure of the gas supply. It was stated that gas-cookers could not be utilized, and that a local jute-works had to close. Mr. A. Brown (the Vice-Chairman of the Gas Committee) said he was prepared to admit that the gas was reduced from a luminant to a non-luminant. A retort was burnt through, and air entered. Further, they were not able to get their supplies of gas oil. In neither instance could they remedy the situation; they were helpless. The Committee were pushing on with the new works; and during next month they hoped to place contracts for plant which would be capable of producing 500,000 cubic feet of gas a day.

LEGAL INTELLIGENCE.

SERIOUS CHARGES AGAINST FORMER GAS OFFICIALS.

Last Thursday, the charge brought by the Walton-on-Thames and Weybridge Gas Company against Thomas Henry Lamb and George Walter Ross [reported in the "JOURNAL" last week, p. 620] was mentioned to a Divisional Court of the High Court of Justice, consisting of Justices Avory, Lush, and Rowlatt.

Mr. COMYNS CARR, on behalf of Lamb, applied for a rule *nisi* for a certiorari calling upon the Justices of Surrey to show cause why any indictment that might be found at the Sessions should not be removed into the High Court. He said he made the application on the ground that the material witness for the prosecution was a Justice of the Peace and a member of the Bench. Prisoners were committed for trial; and he (Counsel) had endeavoured to show by cross-examination that the magistrate, as a Director of the Gas Company, had treated the matter as a civil debt and had accepted payment in satisfaction of the claim. There was authority to the effect that, where a magistrate was interested, this of itself alone was sufficient for granting the application. Here the magistrate, as well as his brother magistrates, had already prejudged the matter that was in issue.

Their LORDSHIPS granted a rule.

GAS POISONING CASE AT HOMERTON.

Inquest and Verdict.

Dr. W. WYNN WESTCOTT, J.P., the North-East London Coroner, held an inquest on Saturday, at the Hackney Coroner's Court, with reference to the deaths of William Deabill, aged 32 years, a chintz glazer, Rosina, aged 29 years, his wife, William, aged 6 years, his son, and Rose, aged 2 years, his daughter, who were found dead at their house, No. 38, Mabley Street, Homerton, having died from the effects of gas poisoning. The discovery was made on the Monday previous, in the afternoon; but the presumption was that they had died some days before, as they had not been seen or heard of since the previous Friday evening.

Mr. C. BEASLEY ROBINSON (Messrs. Monier-Williams, Robinson, and Milroy) appeared to represent the Gas Light and Coke Company, the suppliers of the gas to the house; and Mr. NORMAN SCORGIE, the Borough Surveyor, represented the Hackney Borough Council.

The CORONER, in opening the inquiry, said the four seemed to have died from gas poisoning—illuminating gas—which used to be called coal gas, but was now a mixture of half coal gas and half water gas. If the gas came from the main, it would seem that the pipe was either defective or got cracked in some way; and if the main got cracked it would possibly be due to violence. Perhaps the Gas Company could say.

Mr. ROBINSON: We hardly know ourselves how it happened.

The CORONER: Was the pipe cracked?

Mr. ROBINSON: Yes; but we cannot say whether it was violence or the weather. The cast-iron gas-main was found fractured; and that is all we can say. He went on to remark that the Company wished him to express their deep sorrow at the occurrence; and he felt sure that everybody would join with him in this expression.

William Deabill was then called to identify the bodies respectively as those of his son, daughter-in-law, and grandchildren. They were all, he said, in the best of health when he last saw them.

Dr. *Frederick C. Borrow*, of High Street, Homerton, stated that he was called to the house about 4 o'clock on Monday afternoon, and found the bodies in the back room on the basement floor, which was used as a bedroom. In the front room a cat was lying dead, curled up on the carpet in front of the fireplace. The room with the bodies in was 11 feet square; and he was told that the premises had been just recently occupied. He found the deceased man on his face on the floor, with only his shirt on. His face was pale, with bright rose patches on it, also all over the body. This lead him (witness) to the conclusion that death was due to carbon monoxide poisoning. The room was full of gas; but all the burners were turned off. It was some time before he dared to light a candle in the room, so strong was the smell of gas. In answer to a juror, witness said that death was not due to suffocation but to poisoning; the gas having acted on the brain—the persons peacefully dying. So far as he could see, the boy was quietly sleeping at the time he died; but the mother and baby had been disturbed apparently by the man getting out of bed, and had struggled slightly.

A JUROR: Do you think the father was making an effort to save his life when he got out of bed?

Witness: I think he was staggering to the door, and was overpowered by the gas.

Evidence was then given by Dr. Borrow that death in each case was due to gas poisoning.

Mr. *Argent*, the Managing-Director of Messrs. Achille Serre, said he employed the deceased, who was last seen when he left the firm on Friday evening at 7 o'clock.

Ellen Aiken gave evidence that she occupied the middle floor of the same house with her husband. The last she heard of deceased was on the Saturday morning early, when the baby cried for about ten minutes. She did notice a strong smell of gas, but thought it would go off. On the Sunday morning, when the paper man called, he also referred to the smell of gas, and said he thought it came from the basement, and she decided to warn the Deabills when they came home—she thought they had gone away for a week-end. On Sunday evening the smell became worse; so her husband wrote to the Gas Company; and they also went to the police station. A constable came round to see the place; and, after sniffing about, he expressed himself satisfied, and told them they were quite safe to sleep in their beds. There was not the slightest communication between the middle floor and the basement, either by stairs or anything else; therefore she had no idea how the gas got up into their rooms to smell. She asked the constable to go to the deceased's room, and see if anything was wrong; but he would not. At 1.45 p.m. on Monday afternoon the gas man came; and while he was there somebody came to know why the deceased man had not been to work since the Friday. This caused an alarm, and a man named Morley, who did odd jobs on the buildings, got the master key and opened the door, when the discovery was made.

Charles Morley gave evidence as to the opening of the door, when the gas was overpowering. So far as he could make out the gas came from the cellar; but earlier in the day, when he had put his nose to the letter-box of the door adjoining the cellar, he had not noticed anything particular.

Police Inspector *Henry Marston* said he went on the Monday afternoon, and the footway had then been opened to discover the escape of gas. His examination showed that no food was in the house; so that no preparation had been made for Sunday dinner, showing that death must have taken place on the Saturday.

A JUROR: When the constable took his report back on the Sunday night, what was done?

Witness: I was not on duty at the time.

The JUROR: I should have thought if a police constable was called, and heard that people had been missing for two days, something should have been done—especially when he must have known there was an escape of gas in the house, as everybody could smell it.

Police Constable *W. Sharpe* stated that he visited the house at 11.30 p.m. on the Sunday; and so far as he could make out the escape of gas was from the coal-cellar in the basement. He could not get into the basement premises, and was told the people living there were all away on a week-end. So he decided to simply report to his chief. The smell of gas did not seem to be very serious, and he searched the premises everywhere outside, and found nothing to make him suspicious.

A JUROR: But we do know that at the time four persons were lying dead as a result of gas poisoning.

Witness proceeded to say that he went back to the inspector, told him the result of inquiries, and he telephoned to the Gas Company.

Inspector *Setter* then gave evidence that at a quarter past one on the Monday morning he telephoned to the Gas Company.

Mr. ROBINSON: Did you report on the telephone "Slight escape of gas at 38, Mabley Street; not urgent; morning will do?"

Witness: I did not say anything about "not urgent."

The CORONER: That is most important. You did not say anything about "not urgent?"

Witness: No; nor anything about "the morning will do."

A JUROR: What strikes us as so odd is that no effort was made to go into the premises.

Witness: I was told the people were away for a week-end—a very usual thing for them to do. Had I have thought that there was the slightest suspicion the door would, of course, have been forced.

A JUROR: That is what we want to know—about this delay.

Mr. ROBINSON: Did you take a note of the time, because the Gas Company say it was two o'clock when you telephoned them.

Witness: I am quite sure it was a quarter past one. I have no doubt whatever about it.

Alfred Savage, a watchman in the employ of the Gas Light and Coke Company, said he received the message by telephone at two o'clock of a slight escape of gas; not urgent; morning will do. He entered the call in his book.

The CORONER (examining the book): If you received that message, why didn't you write it so in the book?

Witness: It is there.

The CORONER: There is nothing of the kind. The entry says "Slight escape of gas, to be attended to this morning."

Witness offered no explanation as to the entry, and went on to say that at 7·15 in the morning he reported the matter to foreman Norton for him to attend to.

The JURY said this was the man they wanted to hear, but were informed that the foreman placed the job in the hands of a fitter.

A JUROR: One to the other, and nothing done!

Percy Riddett, a fitter, stated that he received the instructions to go to this house; and after making a number of very urgent calls, he went to No. 38, Mabley Street, which had been reported as a slight escape. He found a strong smell of gas, and concluded that something had happened to the main; so he reported it to the service man.

The CORONER: It sems obvious it was not much use sending you; you did nothing.

Mr. ROBINSON: If nothing is found wrong inside, which would be the job for the fitter, then it is handed over to the service man for outside work. This man had other urgent escapes to attend to on the way.

The CORONER: Are they so common then?

Mr. ROBINSON: Oh, yes!

Witness added that he had no difficulty in finding the service man, who was working at the other end of the street, and was on the job in a quarter of an hour.

William Woollvett, the service man, gave evidence that he got to the place at two o'clock, and at once took up the stones, when he found a broken 4-inch gas-main.

The CORONER: Was it cracked, or had a piece broken off?

Witness: It was cracked right the way round—a very clean crack too; there was no piece missing. He went on to say that he found the crack under the granite setts in the middle of the crossing of Swinnerton Street. He did not believe there was much heavy traffic along there; so he could hardly imagine this was the cause of the fracture. In answer to the Coroner, witness said that before he took up the granite setts there was no sign that the roadway had been in any way damaged; in fact, there was nothing to indicate the cause of it at all. He reckoned the fracture in the main was about 12 to 14 feet from the house, while the main was 26½ inches under the roadway.

A JUROR: It is a very long way for gas to come through the roadway to the house.

Witness: That may be; but it did. He added that the gas-service pipe entered the house from the area, a long way from the crack,

The meter and fittings were in good order, so far as he knew; but they had nothing to do with him.

By Mr. ROBINSON: The main itself was in splendid condition; and the ground underneath was all right. A change of atmosphere might have caused such a clean break as he found.

By Mr. SCORGIE: First of all he had to punch the stones out, and then he had to lift 6 inches of solid concrete before he got to the earth. The stones would be about 7 inches thick, well cemented together; and with those and the solid concrete he certainly would not have expected the gas to get through—in fact, he did not see how it could.

By a JUROR: He tried the pipe in both directions from the crack to see if there was any other defect, but found nothing.

A JUROR: It seems to me that the gas must have got outside the main-pipe, and travelled along to the outside of the service-pipe; and by this means got into the house.

Mr. SCORGIE: It could not have done so, as the service-pipe crosses the area, and is exposed for 4 feet; so the gas would have diffused into the air.

A JUROR: Then it is a mystery how it could ever have got into the house.

The CORONER: Perhaps, Mr. Scorgie, you would like to tell us about it?

Mr. SCORGIE: No, sir, I think the Distributing Engineer will be able to tell you all you want to know. I have my own opinion as to the occurrence; but that does not matter.

Mr. *Henry Sutton Reeson* was then called, and said he was the Distributing Engineer to the Gas Company. He had come to the conclusion that the gas came in through the wall of the coal-cellar and then into the back bedroom. He thought the gas had percolated the stone footway of Swinnerton Street, and thus got to the outer wall of the coal-cellar. The main showed a clean fracture of recent origin. As to the main itself, it was in very good condition. It was laid originally in May, 1898; so its life had been 16¼ years. The depth at the point of fracture was 2 ft. 2 in. In his opinion, the fracture was due to a slight disturbance of the subsoil due to the varying temperature conditions recently experienced. It was well known to water and gas engineers that mains break more in the winter months than at any other time. So far as he knew, there was no heavy traffic that would fracture the pipe.

The CORONER: The recent heavy rains might have had something to do with it.

Witness: Rain would cause the earth to go slack underneath; but it takes days for temperature to affect cast-iron mains.

The pipe was then handed round to the Jury to inspect; and they all agreed it was a very clean fracture.

The CORONER said they could have any amount more evidence; but it did not seem that it would get them any further. They had it definitely that death was due to poisoning; that gas got into the house; and that there was a fracture of the gas-main. But as to the cause of the fracture, there was no evidence to show. This point they would have to leave open, it seemed evident. They could not say anything as to the renewal of the gas-main, as they had evidence that it was in perfect condition.

The JURY consulted, and then found a verdict that death was due to gas poisoning in each case, due to an escape of gas from a main which had fractured, but how such fracture was caused there was no evidence to show, and that such deaths were due to accidental poisoning.

Manchester Street Lighting Experiment.

An inspection of the lighting arrangements in and around the centre of Manchester was made on Monday evening of last week by the Street Lighting Committee, which consists of five members of the Gas Committee, five members of the Electricity Committee, and five members of the Council not connected with either of these departments (with Alderman Smethurst as Chairman). In their tour, the Committee were accompanied by Mr. J. G. Newbigging (the Gas Engineer), Mr. S. L. Pearce (the Electrical Engineer), Mr. F. A. Price (the Superintendent of the Gas Department), and Mr. F. E. Hughes (the Secretary of the Electricity Department). It will be recalled that some time ago an arrangement was made that certain leading thoroughfares should be set apart for experiments by the gas and electrical undertakings; and this Committee, subject to the approval of the Council, have to "determine the method to be employed for the public lighting of the roads, streets, courts, and passages." Referring to the visit of inspection, the "Manchester Guardian" says that the lighting effects were undoubtedly good in both cases.

Messrs. W. J. Jenkins and Co., Limited.

Following up the recent announcement in our pages as to Messrs. W. J. Jenkins and Co. having opened a London office at No. 15, Victoria Street, Westminster, we now learn that Mr. J. E. Lister, who has hitherto held the position of Assistant General Manager at Retford, has been appointed their agent for London and the adjoining districts. This appointment has necessitated the rearrangement of the staff at Retford. Mr. J. A. Ride has been appointed as Assistant General Manager; while Mr. Dallas, who was Outside Manager, has recently resigned, and Mr. C. W. Ward, late Chief Draughtsman, has succeeded him. No less than fifty De Brouwer machines have been ordered and built during the current year, which will bring the total number ordered to upwards of 230. This is evidence of technical judgment as to efficiency and simplicity in working cost. The firm have during the last year or so considerably extended their works, and put down a very great amount of additional machinery. Automatic high-speed machines of the latest type have been installed for dealing with their specialities; and these now enable them to promptly cope with a constantly increasing amount of work. It may here be mentioned that the Company are the makers for England, Wales, and the British Colonies and Japan of the Wilson-Glasgow intermittent-continuous vertical retort system, which has been widely adopted in Scotland, and for which the firm have recently received an order for a 1¼ million plant from the Derby Gas Company.

MISCELLANEOUS NEWS.

EFFECT OF GAS LIGHTING ON COLOURED FABRICS.

Investigation by the British Commercial Gas Association.

Some weeks ago an article appeared in the "Yorkshire Observer" making certain assertions respecting the effect of gas lighting upon coloured fabrics. It was stated that when materials are stored in warehouses lighted by gas a decided deterioration in the colour takes place; and it was implied that the deterioration is due to effects arising from the use of gas for lighting. As this statement, if true, was calculated to do grave injury to the gas industry, arrangements were at once made by the British Commercial Gas Association for severe tests to be carried out to determine what, if any, effects gas lighting has upon coloured fabrics, although it was known that some of the writer's suggestions—such as that sulphuretted hydrogen was one of the damaging elements—were quite unfounded. The Secretary of the Association (Mr. W. M. Mason) has made the preceding observations in a letter to the Editor of the above-named paper, and sent the report received on the experiments made. In view of the publicity given to the original remarks—made, no doubt, in all good faith—Mr. Mason said he was sure space would be found for the entirely reassuring statement of facts which he submitted. The report was as follows; and it appeared in the issue of the "Observer" for last Thursday.

Report on the Experiments.

To determine the effect of gas lighting upon coloured fabrics, some materials (silk and cloth) of various colours were exposed in the following ways.

First Experiment.—A set of colours were exposed so as to receive all the effects of gas lighting—viz., the temperature, illumination, and products of combustion effects. The specimens were simply suspended by a wire in a small compartment, the ventilation of which was artificially restricted. The illumination of the specimens varied between 20 and 40 foot-candles, the temperature 75° to 80° Fahr., and the carbon dioxide 9 to 18 parts per 10,000. It will therefore be seen that all the effects were considerably above what might be regarded as normal; but in spite of this no appreciable depreciation of colour could be found.

Second Experiment.—A second set of colours, exactly similar to those used in the first experiment, were exposed to the temperature and products of combustion effects. They were suspended in an opaque tube placed vertically, so that while free access to the specimens was provided for the vitiated air, no appreciable amount of light could enter. This experiment, as in the case of the first, yielded almost negative results—that is, no appreciable deterioration of the colour could be observed.

Third Experiment.—A third set of colours, exactly as above, were exposed so as to receive illumination and temperature, but so as not to be in contact with the products of combustion. This was done by suspending the specimens of materials in a jar of fresh air, which was then sealed up. The jar was placed in the compartment where the first and second experiments were being made, so that the specimens were exposed to everything except the effects due to products. This yielded almost negative results.

Fourth Experiment.—A fourth set of colours, exactly as above, were exposed so as to receive the effects of temperature only. This was done by suspending the specimens in a jar of perfectly fresh air; the jar being sealed to prevent access of products, and covered with a brown paper jacket to prevent illumination inside the jar. Any effects produced in this case would, therefore, be due to temperature only. Almost negative results were obtained.

This plan of work must have indicated the extent and nature of any effects arising from gas lighting. An objection might be urged against the enclosure of the materials in glass jars to prevent access of products to the air immediately surrounding the specimens, as it might be said that the light, in passing through the glass, would suffer absorption of any ultra-violet rays that it might have originally contained, and therefore the experiments would give false results. When, however, it is remembered that glassware is invariably used with incandescent burners, so that the light necessarily passes through a glass envelope, it will be agreed that the use of glass jars to enclose the samples in no way affects the results and conclusions to be drawn from them.

Fifth Experiment.—In order to have a further control over the experiments, another and exactly identical set of samples as those already described were enclosed in a sealed jar and exposed to daylight.

A sixth set was carefully preserved in a sealed envelope in a cool place away from heated air and products of combustion. These served as a standard of reference for ascertaining the extent of the deterioration in colour of the exposed specimens. The period of exposure was 90 days, at the end of which the various sets of materials were compared with the preserved specimens. In the case of the specimens exposed to gaslight, the exposure was continuous for 24 hours a day; but in the case of the specimens exposed to daylight, the degree of illumination and the temperature necessarily varied throughout the 24 hours.

I am pleased to report that in most cases there was no visible deterioration of the colour of the specimens exposed to gas lighting; and, in view of the various ways in which they were exposed, it seems safe to conclude that the effects arising from gas lighting are of no practical moment.

CHANGES DUE TO DAYLIGHT.

The following summary indicates the various changes due to daylight that were observed in silk materials of the colours named:—

Brown-Green.—The colour had distinctly faded.

Bronze-Green.—The green component of this compound colour seemed to have entirely disappeared, leaving the material with a bronze colour.

Dark Red.—The colour was distinctly paler, as though the material had been partially bleached.

Red-Brown.—The brown component had partially disappeared, leaving the material a brighter red than it was originally.
Bright Red.—A distinct fading had taken place.
Light Blue.—Practically entirely bleached.
Blue.—The colour had darkened appreciably.
Olive Green.—Had only slightly faded.
Dark Olive Green.—Less bronzed than originally.
Light Olive Green.—Distinctly paler, as though partially bleached.
Dark Purple Brown.—Very much bleached.
Purple.—Faded to a brownish tinge.
Dark Khaki.—Turned brown.
Drab.—Changed to a distinct pink.

It is clear from the above that daylight is a powerful factor in the fading of coloured fabrics. In no case did the colour of the material remain unchanged, and in some cases the colour was practically destroyed.

Effects of Gas Lighting.

In regard to the specimens exposed in various ways to the effects of gas lighting, it was found that in almost every case the colours underwent no visible change; and even where change could be detected by careful inspection, it was very slight indeed. The instances where changes could be observed are enumerated below.

Experiment No. 1.—The specimens were exposed to all the effects of gas lighting—viz., temperature, products, and illumination. The following slight changes were observed:

(*a*) The bronze-green had lost a little of its glossy surface, but its colour was intact.
(*b*) The dark red became slightly brighter as the result of exposure.
No other changes could be detected.

Experiment No. 2.—These specimens were exposed to the temperature and products effects only. The following slight changes were observed:

(*a*) The bronze-green silk lost a little of its glossy surface, but its colour was unaltered.
(*b*) The dark red became slightly brighter as the result of exposure.
In every other case no change in colour or general appearance could be observed.

Experiment No. 3.—These specimens were exposed so as to receive only the temperature and illumination effects. The following slight changes were observed:

(*a*) The brown-green had lost some of its glossy surface.
(*b*) The dark red became slightly brighter.
(*c*) The light red had faded very slightly.
In every other case no change in colour or general appearance could be observed.

Experiment No. 4.—These specimens were arranged so as to receive the temperature effects only. In no case could a change of colour be observed. A careful comparison of the exposed specimens with those which were preserved for reference showed that the colour of the materials was intact.

Conclusions.

The results of these experiments show very clearly that any deterioration effect arising from the use of gas lighting is of no practical importance compared with the effect of daylight, more especially when the abnormally severe conditions of the experiments are taken into account.

I am therefore constrained to report that, in my opinion, any deterioration of coloured fabrics that might have been observed in warehouses was probably due to the effects of daylight. It is unlikely that daylight would have been entirely excluded; and seeing that the effect of daylight is so serious, even only a small amount of daylight illumination would produce effects much more serious than incandescent gas illumination.

The effects of daylight can be easily overcome by enclosing the warehoused material behind some simple light-proof curtain. The remedy seems so simple that it is difficult to believe that it has not already been done. So powerful is the effect of brilliant daylight that it is a fact, I believe, that the very best coloured materials will not bear, even for a few days, the effects experienced in and near the tropics.

There is, of course, another aspect of colour deterioration which has nothing whatever to do with the question of lighting, natural or artificial. I allude to the question of purity of the materials used in the manufacture of the fabric. Weight is very often regarded as an index to the quality of material; but while this is true provided the material has not been adulterated, it obviously offers a strong inducement to the manufacturer to provide weight in the form of heavy impurities. Metallic compounds are often used for this purpose in the textile and paper trades. These are liable to chemical decomposition by their action on the air or on the material itself, and discoloration almost necessarily results. The craze for cheapness is the initial cause of this; but as it has no reference to lighting, it need not be any further considered here.

THE WAR AND THE GAS INDUSTRY OF JAPAN.

The first article in the "Journal of the Imperial Gas Association of Japan" for the 15th ult. is devoted to the subject of the effects of the European War on the gas industry of the country. It is by the Editor (Mr. S. Inubushi), and is as follows.

Since Germany stands without rival in the chemical industry of the world, and is almost the sole supplier of nitrate of thorium—an indispensable material in the manufacture of gas-mantles—the present European War, which has for its object the crushing of Germany, is producing almost the same crushing effect upon the gas industry of the world. Thus, in Japan, as in other countries, the first effect of the war to be felt by the gas industry is the suspension of the supply of nitrate of thorium. This is a great blow to the manufacturers of gas-mantles, and is influencing the gas companies as well as the consumers.

The gas-mantle industry of Japan has reached such great developments that it is almost able to supply the demand; very little importation having been carried on during recent years. Some manufacturers had imported a quantity of nitrate of thorium before the outbreak of the war; and the other necessary ingredients or materials being comparatively easy to obtain for the immediate present, it would seem that we have nothing to fear. But should the war be continued very long, there is no use denying the fact that when our present supply runs out the gas-mantle industry will be brought to a standstill, as, all other countries being short of the same commodity, there is little hope that we shall be able to replenish the supply from any other source. Such a condition will produce a great deal of trouble in the gas industry of Japan. There is no doubt that the manufacturers of gas-mantles will be able to supply the demand for a short period; but if the war is prolonged for a few years, they will be unable to meet this demand.

The first natural result of these conditions was seen in the first half of last month [October], when the Tokyo Gas Company were forced to raise the prices by 50 per cent.; and this example, being set by the largest of the gas companies, could not fail to influence other and smaller ones to take similar action. The fear that such an advance in price would adversely influence the consumption of gas by the people has prevented some companies from following the example set by the larger Company, and they continue to sell their own supply at the old rates in spite of the market price. Taking all these considerations into view, it will be readily seen that the management of the gas industry is not an easy matter at this critical moment.

Lead, which is used in the manufacture of service-pipes, is produced in Japan, but it is of inferior quality, so the main supply is imported from Australia; and the shortage of marine transportation due to the war has interfered with the supply of this commodity. It is feared that the manufacture and supply of lead piping will diminish more and more as time advances; and should conditions remain the same in Europe, the price of this commodity will be advanced accordingly. Difficulty in this direction is, it is reported, being already experienced by some local gas companies.

Again, it would be superfluous to add, the rise in the price of coal because of the war is influencing the gas companies adversely. This advance was foreshadowed last year; and even before the declaration of war coal was quoted very high, and the prospect of a lower rate could not be hoped for should the situation undergo no considerable change.

Heretofore we have imported quite an amount of manufacturing supplies—gas plants, apparatus, fixtures, &c.—from Germany; and at present these have been entirely cut off. This does not, however, affect us to any very great extent, as we can turn to other countries for them; and, moreover, home manufacturers can supply all these articles except those specially named.

There is one feature of the present effects of the war upon our gas industry that we wish to present prominently before our readers, and that is the attempt to establish on a large scale a central factory for the recovery of the bye-products of gas. We have frequently mentioned that this branch of the industry is still in its incipiency, due, we presume, mainly to the financial conditions—the cost of maintenance—especially in the small local companies. The necessity exists for development in this direction; but financial shortage, limited manufacture on a profitable or economical basis, &c., have stood in the way of the smaller companies attempting anything in this line of manufacture. These conditions account for the backwardness of the gas companies in this development, although it has a great bearing upon the successful management of the business—a fact which, being overlooked, is hindering the further extension of the gas industry, and has been a source of regret to the far-sighted business men in this line.

To this branch of the industry the war has been a blessing, inasmuch as the leading gas men have wakened to the fact that there is a great need of speedy development of the bye-product manufacture, thereby introducing an innovation in the gas business of the country. The war has practically suspended the importation of various chemicals since commercial relations with Germany have been severed; and this state of affairs is causing our business men to realize the stern necessity of the home manufacture of chemicals. Availing themselves of this opportunity, the gas men are proposing the establishment of a large central bye-product factory, whereby this shortage in chemicals can be supplied at home, and the gas industry secure to itself this great source of business and consequent revenue. Such an establishment would be available to all the local and smaller companies, which up to the present time have been unable to take any part in this branch of their business.

The proposition has been taken up by the Imperial Gas Association, who are studying the best method of the organization and successful promotion of the new industry. They are trying to impress upon the Central Government the importance of the undertaking, and endeavouring to obtain their assistance. Should the projected scheme of wholesale manufacture in one central establishment, or absorbing all the coal-tar products of every gas company, or accomplishing the same results separately at the few principal works at least, be carried through, a complete revision of both management and business results would certainly take place—a fact that would be beneficial not only to the gas industry, but to the entire national industrial circle, and contribute largely to the wealth of the community.

In conclusion, we may state frankly that the present war has brought no benefit to the gas industry of Japan, or perhaps of any other country; in fact, the general business of the industry is checked for all further progress, and the prospect is accordingly far from good. One or two localities experienced an increase in gas consumption owing to the war; but this is more of an abnormal occurrence, and has no durability in it. The gas-mantle manufacturers alone are making money at the present time; but, when everything is most unfavourable to the gas companies, this can hardly be looked upon as having any beneficial connection with the gas industry in general.

New Joint-Stock Companies.—The Yarm-on-Tees Gas Company has just been registered with a capital of £4000 in £1 shares, to take over the undertaking and all (or any) of the assets of the Yarm Gas Company. The Company is a private one; and the Secretary is Mr. W. Selby.——The Hodgson Pump Company has been registered with a capital of £20,000, and the Aerogen Company with a capital of £3000, both in £1 shares.

A NEW GASHOLDER AT HEBDEN BRIDGE.

Opening Ceremony.

The ceremony of inaugurating a new holder for the Hebden Bridge and Mytholmroyd Gas Board was performed on Thursday last. The holder is of the spiral type, with two lifts, built to plans drawn up by the Gas Engineer (Mr. E. J. Wellens). The foundations were made by Mr. Oldfield Watson, of Hebden Bridge; and the holder was constructed by Messrs. R. Dempster and Sons, of Elland. The total cost of the work was about £12,000. The tank, resting upon a concrete base, is 122 feet in diameter, and 26 feet deep. This is filled with water obtained by a Pulsometer from the River Calder, and holds about 2,000,000 gallons. The capacity of the holder is 500,000 cubic feet, sufficient to meet a normal demand for the district for 24 hours.

Mr. ARTHUR SUTCLIFFE, J.P. (the Chairman of the Finance Committee), said that since the Board took over the gas undertaking in 1896, the question of the works and holder storage had been a very difficult problem to solve, not only for the present Board but also for their predecessors. The Chairman had reminded them each year (and the Manager from time to time in making his annual statement) that the matter of another holder would have to be attended to. When the Board took over the undertaking, one holder was discarded because it was leaking. The other one was still in use. At the time of purchase the consumption was only 45 million feet, while to-day the output had reached nearly 106 millions. This extra output had to be dealt with with only half the storage capacity there was when the output was 45 million feet, which was a certain proof of the absolute necessity of providing extra storage. Sir Corbet Woodall, D.Sc., in a report dated 1896, pointed out the difficulties of working under the arrangements which he found existing. In 1903, Mr. Robert Porter, of Elland, and their Manager, both advised the provision of a new holder; and subsequently the Manager again pointed out the need for this. For years the Board had had the matter under consideration, and several sites had been inspected at various periods; but in every case difficulties presented themselves which prevented progress being made. This went on until July, 1910, when land was purchased; and in due course the holder now completed was put in hand.

Mr. JAMES SIMPSON (the Chairman of the Board) remarked that they had had a very anxious time for a number of years. When the site was finally selected, borings were made to decide what class of tank should be adopted, and how deep it would be necessary to go with the foundations; and as a result it was found that a good foundation all over the site would be secured by excavating an average of 4 ft. 6 in. from the sod. Mr. Watson began his work in March, 1913, and completed the concrete bed in July. During the intervening period he had experienced all kinds of trouble—strikes, wet weather, and bad foundations on one side of the site. The contract for the holder and tank was let to Messrs. R. Dempster and Sons, one of the leading firms for the erection of spiral-guided holders; for they had built the largest in the world for the Oldham Corporation, and another very big one at Belfast, besides many others. The work was carried out in a very satisfactory manner, and without loss of life. The scheme included the laying of an 18-inch main over the railway bridge (the bridge also being widened); and there was much anxiety and difficulty attached to this work, which was carried out by the Board's own workmen, under the supervision of the Manager. The concrete foundation of the tank to which he had already referred was 126 feet in diameter, and varied from 2 feet thick in the centre to 6 ft. 6 in. on the outside edge. The diameter of the inner lift of the holder was 115 feet, and the depth 25 feet; the outer lift being 117 ft. 6 in. by 25 feet deep. There was room for a third lift, 120 feet by 25 feet, which would increase the working capacity from 500,000 to 800,000 cubic feet. He proceeded to turn the outlet-valve of the holder.

Mr. C. ROBERTSHAW (the Chairman of the Works Committee) then unveiled a name-plate, which it is intended shall eventually find a home in the new governor and valve-house to be erected on the site.

Mr. J. W. BROADHEAD (the Managing-Director of Messrs. Robert Dempster and Sons) congratulated Mr. Wellens on the completeness of his specifications, the outcome of which was that the holder was finished without a single penny piece of extras. His firm felt proud of the holder; and he was sure the Board would be satisfied with it. On behalf of the Contractors, he asked Mr. Simpson to accept from them a silver rose-bowl, suitably inscribed.

Mr. SIMPSON acknowledged the gift; and a formal vote of thanks to the speakers concluded this portion of the proceedings.

The company then proceeded to the White Horse Hotel, where they were the guests at high tea of the Chairman of the Board and the Chairmen of other Committees. A short toast list was gone through. In proposing "Success to the Gas Board, and its Undertaking," Mr. Broadhead said the business had been very successful. They had a large district to cover, representing 60 miles of mains, which for an output of 106 millions was unique. The undertaking was to be congratulated on being the first of its size in Yorkshire to supply gas to engine-users at the low price of 1s. 9d. per 1000 cubic feet. Mr. Simpson (who presided) said, in response, that from the first the concern was over-capitalized; and the difficulty was that they had to provide for interest on the capital. Mr. Sutcliffe, who also replied, mentioned that £1800 had been allocated to the relief of the rates of Hebden Bridge and Mytholmroyd. Other toasts included "The Contractors."

Sequel to the Neath Gas Strike.—It is to be hoped that the following paragraph from the "South Wales Daily News" was written under a misapprehension of the facts. If not, the Municipal Employees' Association may find something in it worth pondering over: "The recent trouble between the Neath Town Council and their employees, which resulted in the gas supply of the town being cut off for a week, is likely to prove a costly matter for the Neath Corporation, inasmuch as they will lose quite a large number of heavy consumers, who are now having an electric supply installed in their premises. Most of the shopkeepers in the town have already dispensed with gas lighting since the strike; and private consumers are now doing likewise."

SALFORD CORPORATION AND THE PRICE OF GAS.

An Increase Agreed to.

The Salford Town Council, at their meeting on the 2nd inst. [*ante*, p. 557] had before them a proposal of the Gas Commitee to increase, as from Jan. 1 next, the price of gas to ordinary consumers 4d. per 1000 cubic feet, and to reduce the quantity supplied for 1d. through prepayment meters from 35 to 31 cubic feet. It was, however, agreed that the matter should be adjourned for a fortnight, so that a special report of the Committee might be presented When the Council met again last Wednesday,

Alderman PHILLIPS presented the promised report of the Gas Committee, which stated that the financial clauses of the Salford Order came into operation on April 1, 1913, and, as from that date, reductions were made in the price of gas and in the charges for stove-hire which involved a loss of revenue over £20,000 per annum. The statements clearly showed that, in order that the Gas Committee might be able to hand over to the borough and district funds respectively the sums of £2090 and £10,000 for the year ending March, 1915, and to clear the existing indebtedness to the district fund of £9293 in accordance with the provisions of the Salford Order, 1912, it would be necessary to borrow £39,883 from the district fund, as there was no available balance in any reserve fund. The reasons were: (1) Reductions in the price of gas and hiring rates of gas-cookers, followed by a great fall in the market value of residual products. (2) Higher prices ruling for coal. (3) Increased revenue charges due to the much larger demand for gas-cookers, gas-fires, &c. (4) Increased interest and sinking fund charges. (5) Increased expenditure due to the war and to the cost of the Provisional Order. The Gas Committee trusted that the increase in the charges for gas, though now necessary, would only be of a temporary character.

The resolution moved by Alderman Phillips, that the price to ordinary consumers should be increased 4d. per 1000 cubic feet, was lost; an amendment being carried making the advance 3d. Afterwards it was agreed that the amount supplied through slot-meters for 1d. should be about 32 cubic feet, instead of 35 feet as hitherto.

THE PLYMOUTH CORPORATION BILL AND GAS AND WATER MATTERS.

Gas and Water and Municipal Trading.

Considerable discussion took place at the meeting of the Plymouth Town Council yesterday week with reference to the provisions of the Bill which the Corporation are promoting in the next session of Parliament for the consolidation and amendment of their powers under the new circumstances arising out of the amalgamation of the Three Towns. A deputation from the Plymouth and Devonport Mercantile Association attended the meeting, and presented a formal objection to certain clauses which they contended contain provisions for municipal trading detrimental to the interests of numerous tradesmen who depend for a livelihood upon doing work of the class for which the Corporation propose to seek powers.

WATER SUPPLY CLAUSES.

One of the clauses in the Bill as deposited to which some exception was taken had reference to work in connection with the water supply, and had been deleted by the Special Purposes Committee. Mr. Moses moved that the clause be reinstated, and said the objection to it seemed to be opposition to the Water Committee doing their own work in the best interests of the consumers. Its deletion would place the undertaking and the consumers at the mercy of private tradesmen. The Plymouth Corporation hitherto had not had the power which the clause would confer; but it had been exercised with advantage in Devonport. Mr. Daymond urged that injustice would be done to a number of workmen who had been in the employ of the Devonport Corporation, if the work were discontinued. Mr. Smith said that in this respect the clause would make little difference; for if the work was not done by one workman, it would be done by another. It was iniquitous that the private tradesman should have to subsidize the Corporation to compete against himself. The Council decided by 50 votes to 18 to delete the clause; and the Town Clerk explained, in answer to a question, that if the Bill passed the Water Committee could not go on with the work they had been accustomed to do in Devonport, though they might supply meters, as the general law allowed corporations to do this.

Objection was then taken to a clause relating to the charge for water for premises partly occupied for business purposes. The Town Clerk said the figure of 1s. 6d. per 1000 gallons was put in as a maximum, and they would not dream of charging anything like this; but there were certain supplies to Government and other establishments for which it was desirable to have a sufficient maximum. The clause was in the existing Local Act, and its retention would not cause any change in the practice. Unless they had some such provision, they would have very small houses consuming large quantities of water for trade purposes. Mr. Pengelly contended that the provision was applied arbitrarily; some traders being charged, while others were exempt. A motion to delete the clause was lost by a large majority.

POWER TO SELL GAS-FITTINGS.

With regard to the clause providing for the sale of gas-fittings, &c., in the Devonport area of supply, there was also some difference of opinion. A letter was received stating that a representative meeting of plumbers, ironmongers, gas-fitters, and electricians had been held, at which a resolution was passed protesting against the Corporation obtaining powers to trade in appliances and do work connected with the trades in which their capital is invested, and in which their technical skill can be exercised; that such powers are quite unnecessary, seeing that tradesmen can execute such work with efficiency; and that the

unrestricted competition to which they are subject gives a surer guarantee for economy and initiative than any municipal monopoly can offer. The clause relating to gas-fittings reads: "The Corporation may sell, let for hire, or otherwise deal in, fix, repair, and remove, engines, stoves, ranges, pipes, and other fittings."

Mr. Smith moved to delete the word "sell." Mr. Knight thought that if they adopted this amendment they would be "straining at a gnat and swallowing a camel." From the practical point of view, there was little difference between selling a gas engine or stove and letting it for hire. Mr. Moses said the power to sell was freely exercised by the Plymouth Gas Company in their area of supply; and if it was interfered with in the Devonport area, the business of the Corporation gas undertaking would be seriously crippled and prevented from dealing with the poorer classes of the population. If the word "sell" were deleted, it would mean that if persons who had been delighted with gas under the slot installation wanted to have an ordinary meter fixed, the Corporation would be unable to sell them a meter. Alderman Littleton also objected to the alteration of the clause, as calculated to do an injustice to the undertaking. The motion for the deletion of the word "sell" was rejected.

Dealing in Gas in Bulk.

A letter was received from Sir Joseph Bellamy (the Chairman of the Plymouth and Stonehouse Gas Company), in which he said: "I see by the Corporation Bill powers are asked to supply gas in bulk. Why not also seek powers to purchase gas in bulk? A main might be laid from Plymouth to Devonport at joint expense—the Plymouth Gas Company paying for the main to their boundary, and Devonport the same to their border. This might be of immense value to one or both undertakings in the event of shortage of coal arising from strikes, war, &c."

The letter was referred to the Committee in charge of the Bill.

NOTTINGHAM GAS RESERVE.

Trent Navigation Scheme Discussed.

In their endeavour to trench upon the Nottingham gas reserve funds, as the main asset in bolstering-up an engineering scheme of doubtful financial value, supporters of the project for deepening and widening the Trent between Nottingham and Newark have been placed in a position of discomfiture. The matter again came before the City Council at a special meeting on Monday week, when there was a failure to obtain the requisite majority in favour of promoting a Bill for the purpose in the next session of Parliament, though considerable preliminary expense had already been incurred.

The idea of converting Nottingham into a port, to serve as a direct centre of communication between this part of the Midlands and the Humber, is no new one; but apart from the more general criticism that the work was being taken in hand too late in the day, the point of view adopted by many was that, if the monetary potentialities of the scheme were in keeping with the estimates, the Trent Navigation Company might very fittingly undertake the work for themselves, without coming to the ratepayers for assistance. It was suggested that parliamentary powers should be acquired by the Corporation to apply any of the surplus revenue of the gas, water, electricity, and tramways undertakings in support of the plan; but while all the trading concerns of the city were apparently to be laid under contribution—the total estimated cost being £150,000—it had been made abundantly clear in the course of the earlier discussions that it was the gas reserve, as representing the larger nest-egg, which was likely mainly to be affected. The Chairman of the Committee (Alderman A. Ball), while not seeking to detract from the possible general merits of the project, pointed out some weeks ago the danger and unfairness which would be involved by the process suggested.

Following the meeting of the Council, there has been a plethora of interviews with prominent Nottingham men regarding the Corporation's action; and Alderman F. R. Radford, an ex-Mayor, whose municipal activities have been prominently identified with the gas undertaking, has served a useful purpose by laying bare many misconceptions. He has always been a stalwart advocate of building-up an effective gas reserve; but without dealing specifically with the possible effect of the scheme upon this branch of municipal finance, he points out that the probable general result would be a very good bargain for the Company at the expense of the ratepayers. He estimates that the total expense involved would be nearer £170,000 than £150,000, as originally suggested. Taking the annual interest at 4½ per cent. at the present time, including interest and sinking fund, this would amount, in round figures, to £7650 per annum; and allowing credit for tolls, after deducting working expenses, there would remain a deficiency to be met by the ratepayers of approximately £6800 a year. Thus a big hole would soon be made in the gas reserves which it has taken a generation to build up.

After it had been thought that the matter had been disposed of—for a time at any rate—a surprise was forthcoming on Friday, by the summoning of another meeting of the Council for the 30th inst., to further consider the question of promoting the Bill in Parliament. The Town Clerk was originally understood to say that the vote at Monday's meeting was final; but the semi-official explanation has been since vouchsafed that, at the request of Mr. Atkey (the Chairman of the Special Committee), he has thoroughly examined the legal precedent involved, and finds that "in some instances where, though the statutory majority has not been quite secured, the opinion of the local authority has been overwhelmingly in favour of a scheme, the Local Government Board have waived the first meeting as a technicality, and allowed another meeting to be held. The statutory majority must be obtained, however, before permission for the introduction of a Bill will be given by the Local Government Board." It has, therefore, been at the unanimous request of the Trent Navigation Committee that the further meeting has been convened. In the now not improbable event of the Bill being threshed out before a Committee of one of the Houses of Parliament (the number voting in its favour at the last meeting of the Council being only one short of the statutory total required), there may be some discussion as to how far gas reserve funds can be laid under contribution as security for a scheme like this.

PUBLIC LIGHTING OF ALTRINCHAM.

How a Council "Brought Ridicule on Itself."

A state of affairs which astonished the Inspector, and apparently also the Council themselves, was revealed when Mr. H. R. Hooper attended, on behalf of the Local Government Board, to hold an inquiry at the Altrincham Town Hall, with regard to an application made by the Urban District Council for sanction to borrow £675 for the provision of public electric lighting in certain roads.

The difficult (as it transpired) task of explaining the scheme fell to the lot of the Council's Surveyor (Mr. H. E. Brown) who stated that the proposal was to replace 54 incandescent gas-lamps by 72 electric lamps. They expected to obtain a considerable improvement in the lighting; and the ratepayers in the streets affected had expressed their approval of the scheme. The Council had entered into an agreement with the Manchester Corporation, who owned the electrical equipment on the tramway route, for the fittings to be attached to the poles; and this work had been put in hand. The current was to be obtained at 2d. per unit from the Altrincham Electric Supply Company. The power of the present gas-lamps varied anywhere between 40 and 100 candles; and the main reason for the alteration was that the Council desired to get better lighting. He would not say that it was impossible to get better lighting by incandescent gas; but it would mean spending money on new fittings.

In reply to the Inspector, Mr. Brown admitted that he had seen electric lighting vary in the same way as gas, and also that the cost of electricity would be higher than that of the present system. He could not say at the moment how much more the cost would be. No comparison could be made because of the difference in candle power. The Council had received a petition for improved lighting, signed by 150 ratepayers; but he could not point to any complaints having been made. At this point, he said he had obtained the information asked for earlier. The average cost of the present gas-lamps was 32s. each, made up as follows: Gas supply, 18s. 8d.; labour and lighting, 9s. 3d.; renewals of mantles, 2s. 6d.; and upkeep, 1s. 7d. The electricity scheme provided for 22 lamps of 100-candle power, 40 of 200 candles, and 10 of 600 candles. The Inspector said it would have been quite easy to prepare beforehand all the information he was asking for; but as this had not been done, he would make the calculations for himself. It seemed to him that if the lamps were to be lighted for 1923 hours a year, the cost of electricity would be £347 1s., as against only £86 8s. for gas. Mr. G. H. Fawcus (the Manager of the Electricity Company) said the life of the lamps would be longer than the Inspector had allowed for in his calculations. They expected to get altogether 16,000-candle power, compared with 3700 under the existing conditions. Tests had been made which had proved that the lighting would be greater and superior in every way. To this, however, the Inspector retorted that tests proved nothing; they saw very well in London with incandescent gas.

Mr. Brown was then further closely questioned on the subject of cost. The Inspector said he did not know what figures the Council had had before them; but it seemed to him that it was not until now that it had been ascertained what the cost was going to be, otherwise it would have been furnished to him. He understood the work had been begun. Mr. Brown replied that this was so, to the extent of fixing the brackets on the tramway-poles. The figures had not so far been put before the Council in writing. It was, however, putting the matter in rather an extreme way to say—as the Inspector did—that they proposed to spend money without knowing the least bit in the world what the result was going to be. There had been no report prepared as to whether the existing light could be improved at considerably less cost than it was now proposed to incur. The Inspector remarked that it all seemed to him to be a very unbusinesslike proceeding. He inquired for how long a period the price of 2d. per unit had been fixed; and Mr. Fawcus said it was for an indefinite time. There was not at present any agreement as to price; but the Company were prepared to give an undertaking not to increase the charge. On ascertaining that the order was given on Aug. 20 to the Manchester Corporation for the fixing of the brackets on the tramway poles, he pointed out that this was two months before the Council decided to apply for the loan.

Opposition to the scheme was offered in more than one quarter, Councillor Birtles said he was surprised to hear that the work had been proceeded with in so irregular a manner. There was no urgent necessity for any alteration in the lighting. The town was well and economically lighted; and he was opposed to any further expenditure. It was unfair to put a perpetual charge on the whole town for the lighting of two or three short streets. The Council had not been agreed upon the matter; and the members had never been posted up with the facts. Mr. Fairhurst (a large ratepayer and a Director of the Gas Company) also protested against the proposed expenditure. He stated that at present the main streets were lighted with lamps about 60 yards apart; and the smallest possible burners were used. One-third of the lamps were out of order, with damaged mantles and broken glasses. The burners were not removed during the summer, but were kept on from year's end to year's end, and "were abominably attended to." They would get much better results if they had some competent person at the head of the lighting department. Councillor Pearson (the Chairman of the Lighting Committee) said he attended the inquiry to support the application; but after hearing the figures, he really could not see his way to do so. They worked out very differently from those put before the Committee. The reason the order was given for some of the preliminary work to be done was because the men were practically idle.

Consultation then took place, as the result of which it was decided that the application should be held in abeyance until the Council had had an opportunity of further considering the matter. Before the adjournment, however, Mr. Fawcus said the figures which had been given as the cost of electric lighting were the maximum; and it was very unlikely they would be reached. The arrangement was such that alternate lamps could be used. Councillor Tadman (the Chairman of the Council), too, had something to say. He declared that when the

matter was considered by the Council a price was given, and the Council understood that the cost of electric lighting would not exceed that of gas. Personally, he was opposed to the fixing of the brackets being proceeded with before the loan was sanctioned.

A meeting of the Council was held subsequently to consider the position; and several members expressed surprise that the case had not been got up with greater care. It was said that if members had been made aware that the cost would be so great, the application for the loan would never have been made. Mr. Gatley remarked that the Council had "brought ridicule on itself," and every member must be prepared to accept his share of the blame. In the end, it was decided that the application for the loan should be withdrawn, and that the matter should be reconsidered six months hence.

POWER GAS CORPORATION, LIMITED.

Profits Increased—Some Important Contracts Completed.

The Fourteenth Ordinary General Meeting of the Corporation was held last Thursday, at the Westminster Palace Hotel, S.W., under the chairmanship of the Rt. Hon. Sir ALFRED MOND, Bart., M.P.

The GENERAL MANAGER AND SECRETARY (Mr. Wilfrid Beswick) read the notice convening the meeting and the Auditor's certificate.

The CHAIRMAN, in moving the adoption of the report and accounts, said that, from the financial point of view, the Corporation were in a very strong position—a remark which he justified by an analysis of the accounts, and a comparison with those of the preceding year. This gratifying condition of affairs, he went on, was due to two causes—the main one being that a number of important contracts were closed during the year, and money which had been outstanding a long time was at last received. The profit made during the year was £20,510, compared with £16,000 in the preceding twelve months, or an increase of £4500. He thought the shareholders had every reason to be satisfied with this profit, which was the highest made by the Corporation since its inception. With the amount brought into the accounts of £3549, this profit left a disposable balance of £24,000, compared with £19,000 for the preceding financial year. After considering how best to deal with the amount, the Board proposed to transfer £4100 to the reserve fund (which was the largest amount that could be transferred under the Articles of Association), to pay the same dividend as before (namely, 5 per cent. per annum, less income-tax), which would absorb £12,481, and carry £7479 to the next accounts. This would increase the carry-forward by £4000 over what it was last year. The Directors could, of course, have increased the dividend out of the profits of the year—and perhaps legitimately so; but in view of the conditions under which they were working at the present time, he thought the shareholders would agree it was wiser to be conservative, and keep a considerable amount in hand for contingencies, which might or might not arise. As their financial year ended at Sept. 30, it included practically two months of the war; and in a business such as theirs it was not unnatural that the outbreak of a great war should lead to the stoppage, delay, or cancellation of very considerable orders. The financial year under review was therefore unfavourably affected; and it was, of course, impossible to state what the result would be so far as the present twelve months were concerned.

Referring to the work done, the Chairman said the Corporation had during the past year both obtained and completed some interesting contracts. A very important one was with the Japanese Government, for the electrification of their railways. It was the first large plant of gas-engines, producers, and dynamos running on railway work. The job was a difficult one; but official tests showed that the performance of the plant was considerably better than the promises made with regard to it. In view of the electrification of British railways, it seemed a pity that the first modern plant of this kind should not have been erected in our country. Another important contract was one which had been carried out for the Birmingham Corporation. This plant, which was the first of its kind, and had a daily capacity of from 90 to 100 tons, had for its object the firing of coke-ovens at the gas-works. It was an entirely new departure in gas-works practice. He was glad to say that the tests of the plant were very good indeed, that the Corporation had taken over the installation, and that the results appeared to satisfy the Engineer who proposed this ingenious combination. One of the most gratifying features of the business was the number of duplications of plants and extensions they were putting down for customers who started their installations in some cases many years ago. This proved that people who adopted the system were satisfied with the results obtained. An interesting plant which had been put down during the year, and had been in use several months, giving great satisfaction, was for the purpose of melting steel by Mond gas. Then they had completed an order (which had since been duplicated) for Accrington for electrical purposes; and this he hoped would lead to other municipal authorities entering the field of cheap power production by means of Mond plant and gas-engines. Another branch of work which had recently been successfully undertaken by the Corporation was the construction of ferro-concrete buildings.

From what he had said, concluded the Chairman, the shareholders would agree that there was good reason to be satisfied with the progress made; and in this connection he wished to acknowledge the loyal services of the staff. The Corporation were somewhat short-handed now, owing to the number of men who had joined the Colours, and to the very large demand there was on Government work for men engaged in the engineering trade. However, the Board hoped to get through the year in a satisfactory manner, and that the balance-sheet next year would not show any serious falling away from the positiou they were now in.

The report and accounts were unanimously adopted; and the business subsequently transacted included the confirmation by the shareholders of the appointment by the Directors of Mr. Beswick to a seat on the Board. Mr. Beswick, the Chairman pointed out, has been with the Corporation since its formation.

PRICE OF GAS IN BRISTOL OUT-DISTRICTS.

Reply of the Board of Trade.

The recent agitation with regard to an increase made by the Bristol Gas Company in the price of gas supplied by them to certain Gloucestershire parishes, resulted in a communication by the Warmley and Kingswood Councils complaining of the action of the Company. The Board of Trade have now replied; and the nature of the reply was stated at a meeting of the Warmley Rural District Council last week. The Board of Trade said that, on receipt of the complaint, they communicated with the Bristol Gas Company on the subject. They enclosed the Company's reply, and added that the matter did not appear to be one in which the Board had any power to intervene further. The letter enclosed, which was signed by the Secretary of the Company, on behalf of his Board, set forth the circumstances of the case. It was in the following terms.

"The maximum price of gas fixed by our Act of Parliament of 1853 (not since varied) is 4s. 6d. per 1000 cubic feet; while up to Sept. 30 last year our charge was 2s. per 1000 feet, subject to an allowance of 6d. per 1000 cubic feet. I think we are the only Company in the kingdom who supply gas in the outside districts at the same price as within the city boundaries. I would further say that some few years ago we charged the outside districts as much as 6d. per 1000 cubic feet more than in the city; but we have gradually reduced the figure I have given you. The value of the gas sold in the Kingswood district during the year 1913 was £6999, of which £3657 was charged at 1s. 6d. per 1000 cubic feet. On reference to 'Field's Analysis' (a standard work on gas companies' accounts), it will be seen that our cost for producing gas was 1s. 8 08d. per 1000 cubic feet; so that more than half the consumption in the Kingswood district was supplied at less than the gas actually cost us. Further, the Council state that our assessment was raised to £720 by mutual consent. This is incorrect. We gave notice to the clerks of the various Assessment Committees of our intention to appeal. We appeared before the Assessment Committees, and made what we considered a fair offer, which they refused. Our assessment in Kingswood was raised to £720, which we absolutely declined to accept. I may add that before the appeal I made every effort to meet the Overseers of the Assessment Committee, in order to discuss the matter, and see if any agreement could be come to; but I failed to obtain any appointment. The request made to us to receive a deputation from the Kingswood and Warmley District Councils was only made after the appeals had been heard and the assessments fixed."

THE ELECTRICITY SUPPLY SCHEME FOR LONDON.

In previous issues of the "JOURNAL"—particularly in our "Electricity Supply Memoranda"—references have appeared to the large scheme of electricity supply proposed by the London County Council, by which it is intended that, sooner or later, the whole of the electricity supply of London shall be concentrated under one authority and the electrical energy be derived from only some half-dozen stations, instead of the considerable number in existence now. The principle on which the Council have been going is that of completely unifying and co-ordinating the whole system, so as to relieve London of the several different systems that now obtain.

The matter again came before the London County Council at their meeting last Tuesday, when the Parliamentary Committee presented a report on the Bill which it is proposed to promote in Parliament during the current session. Although the Bill does not apparently commend itself entirely to the Progressive section of the Council, in view of the fact that it does not make the Council the sole central electricity authority, the resolution agreeing to the promotion of the Bill was duly passed.

CONSTITUTION OF AUTHORITY.

In the report of the Parliamentary Committee, it is first explained that the area of supply to be covered by the scheme comprises the counties of London and Middlesex and parts of Essex, Hertford, Kent, and Surrey. Then it is pointed out that the Bill provides for the establishment of an authority to be known as the "London Electricity Authority." It is suggested that representation shall be based on assessable value; one member being appointed by each of the authorities concerned, with the addition, in each case in which the assessable value exceeds two-and-a-half million pounds, of one member in respect of each two-and-a-half million pounds of such excess. Under these conditions the representation would stand as follows. In the draft Bill it was provided that the members of the authority need not be members of the appointing authority; but in view of the financial and other interests of the County of London in the scheme, the Committee proposed that not less than half of the representatives of the Council should be members of that body. When, however, the report came before the Council, an amendment to this was proposed in favour of a suggestion of the Local Government Committee that the Council should have at least fourteen of their own members as members of the authority. If Parliament agrees, it will be seen that on the authority the London County Council will have an absolute majority.

Following upon this are the provisions for transferring and vesting in the Council the rights of compulsory purchase of existing undertakings now possessed by the various local authorities within the area of supply, together with powers for the leasing and transfer of company and local authority undertakings.

POWERS OF SUPPLY.

The basic principle of the Bill is that all the powers of the Bill shall be conferred on the authority, but that the powers relating to supply and the construction of works, the purchase of lands, and the purchase of undertakings by agreement shall be delegated by the authority to an operating company.

It is provided that the authority shall supply electrical energy only:

(1) To authorized undertakers in the area of supply and in areas contiguous to such area; (2) to any company, body, or persons owning or working any railway, tramway, tramroad, canal, navigation docks, or water-works; and (3) for general purposes (*a*) in any area not forming part of the area of supply of any authorized distributor or within any part of the area of supply of an authorized distributor in which a general supply of electrical energy is not being given; and (*b*) in the district of an authorized distributor with the consent of such authorized distributor. As to (2) a limitation is provided as to the amount of energy so supplied which may be used for lighting purposes.

PRICE OF SUPPLY.

The maximum price for bulk supply or for power supply to any company, body, or person, owning or working any railway, tramway, tramroad, canal, navigation, docks, or water-works is not to exceed a fixed sum of £3 10s. a kilowatt of the maximum power required to be supplied, and in addition a sum of 0·25d. a unit for all units supplied to such consumer. As regards general supply, it is provided that the authority shall as soon as reasonably practicable after the expiration of five years from the date of the deed transferring the undertaking to the operating company apply to the Board of Trade to fix or revise the maximum prices for such supply.

OPERATING COMPANY.

The Bill provides for the transfer to a company, for a period not exceeding fifty years, of the powers relating to the supply of electricity and the execution of works, the purchase of undertakings by agreement, and also the transfer of any undertaking or part of an undertaking purchased or taken over by the authority. At the expiration of the period the undertaking will vest in the authority on payment to the company of a sum equal to the capital raised (otherwise than by advances from the authority) and properly expended by the company for the purposes of the undertaking after deducting therefrom an amount equal to the aggregate sum, if any, by which any payments to sinking or redemption fund in respect of capital raised by the company are in arrear.

FINANCIAL ARRANGEMENTS.

The Bill provides that the authority may make such advances to the company as the company may from time to time require: (1) For capital expenditure for the purchase of any undertaking, (2) not exceeding two-thirds of any other capital expenditure of the company. Power is also included to enable the authority to guarantee interest on capital raised by the company as an alternative to the advance of such capital.

It is provided that the authority may expend on capital account (1) such sum as they may from time to time think fit, not exceeding £10,000,000; (2) any sum payable by the authority on the termination of the interest of the operating company in the electrical undertaking; (3) such further sums as may be necessary for the purchase of undertakings and for advances to authorized undertakers; and (4) such further sums as may be sanctioned by the Board of Trade. It is suggested that £10,000,000 would probably cover the expenditure of the authority for capital purposes during a period of ten years after the works are commenced.

Provision is made to enable the company to raise capital, and also to issue shares, bills, and bonds for the purpose of discharging its capital liabilities. Then follow powers regarding sinking funds and reserve funds; and then we have the method by which it is proposed the net revenue of the undertaking shall be dealt with. It is to be applied towards: (1) The payment of the expenses of the authority, including interest on the proportion of capital found by the authority; (2) the provision of a sinking fund on the authority's capital; (3) the payment of dividends on the capital found by the company, at a rate to be fixed by the deed of transfer; (4) the provision of a sinking fund on the capital found by the company; (5) the formation of a reserve fund, calculated at one-half per cent. per annum on the whole of the capital of the undertaking; (6) any further profits over and above the deductions for interest, sinking fund, and provision for reserve, already referred to, to be divisible between the authority and the company, in manner to be prescribed by the deed of transfer, until the company receives a share sufficient to pay further dividends upon its capital expenditure, making in all a return of 8 per cent. interest to the company. Any further profits are to be utilized in giving a rebate on the prices charged to consumers, the relief of rates, and the payment of further dividends or other such purposes as may be specified in the deed of transfer, provided that the company may carry forward such balance on revenue account in any year as the authority may consider to be reasonable. As regards sums applied to the relief of rates, it is provided that these shall be apportioned between the councils entitled to be represented on the authority in proportion to the assessable value of the area or so much of the area of the respective councils as is within the area of supply, and shall be carried to the credit of the county fund or the borough fund, as the case may be.

TECHNICAL COMMITTEE.

Provision is made to enable the authority to establish a small permanent body, to be known as the "Technical Committee," to include the Chairman of the authority (*ex-officio*), the Engineer of the authority, the Financial Adviser to the authority, and an outside member appointed by the Board of Trade. The Bill is to provide that, if established, the Committee shall advise the authority in regard to matters arising under, or in pursuance of, the powers of the Bill, and that the authority may, if it thinks fit, delegate to the Committee, with such restrictions or conditions as it may prescribe, any of the powers and duties vested in or exercisable by the authority with regard to the supervision of the company.

MISCELLANEOUS.

The report of the Parliamentary Committee in its concluding parts refers to such subjects as the relations of the authority with existing undertakings, the lapse of powers, and a few miscellaneous matters which are not such essential parts of the scheme as those noted above.

[A reference to this matter is made in to-day's "Electricity Supply Memoranda."]

POSITION OF THE OLDBURY GAS UNDERTAKING.

It may be remembered that at the last meeting of the Oldbury District Council the position of the gas undertaking was the subject of some criticism. In a letter signed "Fiat Justitia" in last Saturday's "Midland Chronicle," the following remarks were offered by way of answer: "During the seventeen years ending March, 1912, nearly £9000 was handed over from the gas-works to the relief of the public rates. Since then about £1600 has, I believe, been given indirectly—that is, the charges for public lighting have been reduced to this extent. Upwards of £13,000 has been spent on the extension and improvement of the works, &c.; these charges also have been met by the profits. The conditions prevailing in the gas industry at the present time which justify a slight increase in the charges for gas are unique, and are not by a long way confined to the Oldbury works alone. In the past a high price for coal has always been followed by a good market for coke, tar, &c. Now gas-works are paying a high price and receiving a low one, owing to circumstances outside the control of anyone. The policy of charging a low price for gas for cooking and power was a sound one, and has no doubt greatly aided the increased output, which is now 160 millions per annum against, 71½ millions in 1894. The question of a lower price for gas for cooking and heating is one that all gas undertakings will have to face in the near future. On this point Oldbury has, perhaps, been a little ahead of its neighbours. The overdraft of £6000 odd is solely owing to the money borrowed from the bank for the new gasholder (as pointed out by the Clerk), and has nothing to do with the high prices for coal or the low prices for residuals. Finally, I would point out that whatever was done at the gas-works during the whole of the twenty-two years the late Engineer was in charge had the sanction of the Gas Committee and the confirmation of the Council then in office." The writer considered that he had said enough to show that the charges of "mismanagement" and "bankruptcy" were, to say the least, unfair and unjust.

GAS-WORKS EXTENSIONS AT DUNOON.

Extensions to the gas-works at Dunoon, on the Clyde coast, were formally opened last Saturday week. The ceremony was performed by Mr. Dunbar (the Convener of the Gas Committee). There is a new gasholder, by Messrs. Henry Balfour and Co., of Leven, and an installation of Glover-West vertical retorts. The cost has been some £15,000. A tour of inspection having been made of the works, luncheon was served in the Argyll Hotel—Provost TANNOCK presiding.

The PROVOST said that the motto of the burgh was "Forward." This meant that when the Town Council took any matter in hand they never looked back. The extensions were necessary to meet the demand during the summer—especially at the time when visitors came. When Mr. David Robertson (their Engineer and Manager) proposed vertical retorts, the Council visited Scotch and English towns and saw the system in operation.

Major BENNETT proposed "The Gas Committee."

Mr. DUNBAR, in replying, stated that in 1912 the highest daily delivery at the works was 181,000 cubic feet; but this year the figure had reached 245,000 feet. Fourteen years ago the capital debt was 26s. 1½d. per 1000 cubic feet; now it was 17s. 10½d. He felt confident the Contractors' guarantees would be fulfilled. Other new plant was an "Eclipse" washer-scrubber by Messrs. Clapham Bros., and a "Rotary" meter. The gasholder would contain 250,000 cubic feet. While the consumption had practically doubled in fourteen years, the capital had increased only about 34 per cent.

Mr. TURNER, who proposed "The Contractors," said that so far the work had given the utmost satisfaction.

Mr. FRED. J. WEST, replying, remarked that some of their material was on the eve of being shipped by his firm to Austria when the war put a stop to it, and the plant was now being utilized for towns in Great Britain.

Mr. JAMES MACLEOD spoke of the high place Mr. Robertson had among gas managers.

WORKING RESULTS AT COLWYN BAY.

Profit-Sharing Suggested.

In the course of his report on the working of the Colwyn Bay gas undertaking for the year ended March 31 last, Mr. J. Smith (the Engineer and Secretary) recommends the Urban District Council to adopt a profit-sharing scheme for the benefit and encouragement of the workmen. He points out that, as from July 1 last, the price of gas to all consumers was reduced 5d. per 1000 cubic feet, and expresses the hope that consequent increases in sales will assist in reducing the present high ratio of capital charges to production.

As to the results, Mr. Smith states that the quantity of coal carbonized during the twelve months was 7031 tons, which produced 85,000,000 cubic feet of gas, or equal to 12,112 cubic feet per ton of coal. This was a decrease of 80 cubic feet over the yield of the previous year. The results are again good, considering that lower-grade coal has been used, which has been obtained at a very slight increased value per ton, though the market price shows an advance of from 2s. to 3s. per ton over that of the previous contract. The yield from residual products has been lower; hence an increase in the net cost of coal per ton. The new carbonizing plant has worked satisfactorily, and has yielded a good return on the outlay. The saving in wages has been fully £300 during the time it has been at work. For the coke produced the market was rather weak during the year—especially from October, 1913, when a severe slump set in. The main reasons for this were the mild winter and the dearness of gas oils, which necessitated all water-gas plants being put out of action. With the exception of about 30 tons, the whole of the sales of coke were local. The net cost of the manufacture of gas was 10·18d. per 1000 cubic feet, as compared with 9·214d. in 1913, and 1s. 0·598d. in 1912.

RATES AND GAS, ELECTRICITY, AND WATER CHARGES.

Annual Tabulated Statistics.

Mr. James Carter, the Borough Treasurer of Preston, has forwarded a copy of his tabulated statistics of rates levied, together with charges made for gas, electricity, and water, and profits and losses on municipal undertakings in a number of Provincial towns and some Metropolitan boroughs for the year 1914-15. There are in all 134 places referred to, which is the same as in the immediately preceding compilation. The populations range from 868,430 in Birmingham (old area) down to 20,221 in King's Lynn.

The rateable values are highest in Westminster (£6,784,500), Liverpool (£4,883,857), Manchester (£4,741,001), Birmingham (£4,498,420), Kensington (£2,443,249), Leeds (£2,226,552), and Sheffield (£2,043,415). They are lowest in King's Lynn (£86,545), Brighouse (£90 890), Bacup (£91,345), and Ilkeston (£91,358). The places rated at 9s. or over in the pound are: Bacup, 9s.; Birmingham, 9s.; Brighouse, 9s.; Chatham, 9s. 1d.; Leeds, 9s. 1d.; Stalybridge, 9s. 1d.; Walsall, 9s. 1d.; Chesterfield, 9s. 2d.; Wolverhampton, 9s. 2d.; Bradford, 9s. 3d.; Ilkeston, 9s. 4d.; Heywood, 9s. 5d.; Sheffield, 9s. 5d.; Rotherham, 9s. 6d.; Hull, 9s. 7d.; Batley, 10s.; Colchester, 10s.; Halifax, 10s.; Lowestoft, 10s.; Stoke, 10s. 2d.; Merthyr Tydfil, 10s. 7d.; West Ham, 10s. 7d.; East Ham, 11s. 1d.; and Norwich, 11s. 3d. Those fortunate enough to have rates of 5s. or less in the pound are: Oxford, 4s. 7½d.; Blackpool, 5s.; and Bournemouth, 5s.

Out of the rents of property and profits transferred from municipal undertakings, the rates are reduced in the following towns to the extent of 1s. or more in the pound: Warrington, 1s. 7½d.; Yarmouth, 1s. 7d.; Nottingham, 1s. 6d.; Darlington, 1s. 5d.; Colne, 1s. 4d.; Rotherham, 1s. 4d.; Halifax, 1s. 2½d.; Leeds, 1s. 2½d.; Stockport, 1s. 2½d.; Leicester, 1s. 2½d.; Stafford, 1s 2½d.; Liverpool, 1s. 1⅞d.; Bolton, 1s. 1½d. (water profits to reserve); Wallasey, 1s. 1½d.; Burnley, 1s. 1d.; Mansfield, 1s. 1d.; and Lancaster, 1s. 0½d. On the other hand, profits equal to 1d in the pound, or less, were contributed in aid of the rates by Hammersmith, 1d.; South Shields, 1d.; Eastbourne, ¾d. (electric light profits to reserve); Lowestoft, ¾d.; Newport (Mon.), ¾d. (water profits to reserve); Worthing, ¾d.; East Ham, ½d.; Hampstead, ½d.; Hove, ½d.; Kingston-on-Thames, ½d.; Middlesbrough, ½d.; West Hartlepool, ½d. (electricity profits to reserve); Bournemouth, ½d.; Eccles, ½d.; Stalybridge, ½d.; Stoke, ½d.

There were, out of the total of 134 places included in the list, 25 which made no profit for the reduction of the rates, though five of them earned profits which were carried to reserve. There are given in a separate table no less than 63 instances of the rates having been increased in consequence of losses on one or more municipal trading undertakings. The heaviest of these losses occurred in connection with water-works at Birmingham (£82,000), Stockport (£23,654), and Swansea (£22,754). There were deficiencies totalling £34,700 at Preston. No losses on gas are shown; but deficiencies on account of electricity are reported from Bath, Heywood, Hove, Ilkeston, Ipswich, Kingston-on-Thames, Newport (Mon.), and Wigan. At Bacup water losses were responsible for an addition of 2s. 0½d. in the pound to the rates. Water and electric light losses at Heywood added 1s. 9¾d. to the rates; and the deficiencies at Preston, 1s. 7½d.

A table giving the charges for gas, water, and electricity in the towns dealt with by Mr. Carter, shows that the net price of gas for domestic lighting supply is highest at Lowestoft—3s. 7d. per 1000 cubic feet; while it remains lowest at Widnes—1s. per 1000 cubic feet, with a rate lower than this for large consumers, engines, &c. In the following towns, also, the charge for gas for domestic lighting is 2s. or less per 1000 cubic feet: Sheffield, 1s. 3d.; Belfast, 1s. 8d.; Plymouth, 1s. 9d.; Sunderland, 1s. 9d.; Keighley, 1s. 9¾d.; Bath, 1s. 10d.; Birmingham, 1s. 10d.; Gloucester, 1s. 10d.; Lancaster, 1s. 10d.; Luton, 1s. 10d.; St. Helens, 1s. 10d.; Gateshead, 1s. 10½d.; Newcastle, 1s. 10½d.; Stoke-on-Trent, 1s. 10¾d. (average); Bury, 1s. 11d.; Huddersfield, 1s. 11d.; Oldham, 1s. 11d.; Bradford, 1s. 11¾d.; Burnley, 1s. 11¾d.; Blackpool, 2s.; Bristol, 2s.; Burton-on-Trent, 2s.; Carlisle, 2s.; Cheltenham, 2s.; Darlington, 2s.; Halifax, 2s.; Lincoln, 2s.; and Wallasey, 2s.

The charge per Board of Trade unit for domestic supplies of electricity ranges from 7d. at Stoke-on-Trent, 6½d. at Bournemouth and Preston, and 6d. at Oxford, down to 2½d. at Halifax and Southampton, 2¾d. (flat rate) at Burnley and Bury, and 3d. at Ashton-under-Lyne, Belfast, Birmingham, Hyde, Ilkeston, Stalybridge, and West Ham (flat rate).

The charge for water for domestic purposes on a house of £15 rateable value is highest in Lincoln, at 2s. 4d. in the pound; while the rate is 2s. at Bacup, Bury, Harrogate, Heywood, Huddersfield, Leigh, Rawtenstall, Rochdale, and Rotherham. The charges are lowest in the following towns: Liverpool (within the city limits), 6¾d.; Southampton, 7d.; Worcester, 8d.; King's Lynn, 8¾d.; Brighton, 9d.; Hove, 9d.; Leamington, 9d.; Manchester (within the city limits), 9d.; Peterborough, 9d.; Richmond (Surrey), 9d.; Worthing, 9d. The charges are also less than 1s. in: Bournemouth, Crewe, Gloucester, Oxford, Plymouth, Reading, Widnes, and York.

At Preston, the rates are 8s. 10d. in the pound; and they are relieved to the extent of 9¾d. by the profits transferred from reproductive undertakings. On the other hand, however, as already mentioned, there are the deficiencies which increase the rates by 1s. 7½d. in the pound. The price of gas at Preston for domestic lighting is 2s. 8d. per 1000 cubic feet; of electricity, 6½d. per unit; and of water, 1s. 6d. in the pound on £15 houses.

Meter-Union Locking Device.—Mr. Henry Corcoran, of Bray, has applied for a patent for a meter-locking device for the prevention of attempts at obtaining gas by false pretences. The device is applied to the pipe-unions of meters, so that it is impossible to disconnect the union and divert the flow of gas before passing through the meter.

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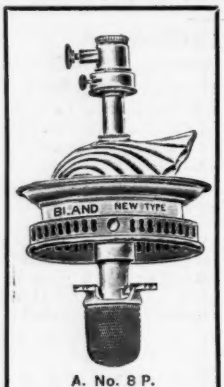

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List of British Patents Granted to Germans and Austrians.

By virtue of the provisions of the Patents, Designs, and Trade Marks (Temporary Rules) Act, 1914, any person may apply to have any of the hereunder patents revoked or suspended, providing that such person applying can satisfy the Board, or any person whom they may appoint for the purpose, that the patentee or licensee is the subject of a state at war with His Majesty, that such person applying intends to manufacture, and that such revocation is in the general interests of the country or of a trade. The list is contributed by Messrs. Hughes and Young, Patent Agents, of 55 and 56, Chancery Lane, W.C., who will furnish readers with any further information they may require.

21,359 (1912).—W. ZIMMERMANN, "Gas manufacture."
24,165 (1912).—G. THOMMEL, "Gas-valves."
9499 (1913).—BRENNSTOFFVERWERTUNG GES., "Gas manufacture."
9538 (1913).—N. REIF, "Actuating gas-valves."
9678 (1913).—L. SCHMIDT, "Gas-burners."
18,413 (1913).—T. DE FONTAINE, "Gas-generators."

GAS V. ELECTRICITY FOR ARTISANS' DWELLINGS.

Dundalk Council Objects to Gas.

The Dundalk Urban District Council had under discussion at the last bi-monthly meeting the question of the lighting of their artisans' houses. Early in the year, the Engineer and Manager of the Gas Company (Mr. George Airth) canvassed the tenants of the houses, and 54 of them were in favour of gas. He thereupon applied to the Council for permission to lay it on, but had no reply to his request. In September he made another canvass, with a result similar to that previously obtained. He then addressed a second letter to the Council, and in reply was informed by the Town Clerk that the Council refused to allow gas to be put into their houses "for any purpose." The matter came up on the receipt of tenders which had been invited for wiring the houses for electric light.

The TOWN CLERK (Mr. N. Comerford) mentioned that he had notified the tenants to attend to sign contracts for the payment of 3d. extra per week for the electric light, but only fifteen of them had done so. A memorial had been signed by 44 out of 59 tenants who wanted the light.

Mr. DALY thought the tenants should have permission to put in gas-stoves, but it had been refused. Sixteen out of eighteen of the Commissioners had these stoves.

Mr. HAMILL said if it was the wish of the tenants to get in gas-stoves he did not think the Council should prevent them.

The CHAIRMAN (Mr. S. H. Moynagh): If a tenant wants to get in a gas-stove, I would certainly say, "Give it to him."

Mr. M'GAHON said the houses were the property of the ratepayers, as was also the electric light undertaking. The Gas Company was a concern in direct opposition to them as regards lighting; and he thought they should support the undertaking which they controlled themselves. This was a contest between the Company and the Council. If gas-stoves were put in, the houses would be lighted with gas. A very small number of the tenants seemed anxious to score a point off the Council, whether or not the reasons were political he did not know. The question had been discussed by the Council in committee, and they refused to permit the Gas Company to put in gas-stoves, and directed their Engineer to prepare a specification for the lighting of the houses by electricity. He had done this, and now, when the tenders came up, a final effort was being made by the Company to get gas into the houses. As ratepayers they should support their own institutions. The question of gas-stoves for cooking was all a piece of humbug. They did not provide an economical method of cooking at all; and whether for cooking or for warmth a coal fire was superior to them.

Mr. REILLY asked if the rent of 3d. per week would be sufficient to cover the expense of the installation and pay for the electricity.

Mr. M'GAHON said the rent was sufficient; but even if it were not, the Council would be showing a good example to other landlords by providing in this way for their tenants.

Mr. REILLY: If a person in any other line of business compelled his tenants to deal with him, we should call it "coercion."

Mr. P. A. SPALDING (the Electricity Engineer) mentioned that since the matter was last before the Council a new and cheap apparatus had been put on the market, which would enable electricity to be supplied for cooking at a low figure. He thought the Council would be now in a position to meet the demands of tenants in this respect.

It was eventually decided to accept the lowest tender (£66), and to have all the houses wired; Mr. Spalding to submit a scheme which would enable electricity to be supplied for cooking purposes.

Gas-Works Extensions at Doncaster.—At a special meeting of the Doncaster Town Council last Thursday, it was decided to promote the Bill, for which notice has been given [see *ante*, p. 484]. The entire scheme of improvement contained in the Bill will, it is expected, entail an expenditure of £200,000, of which £65,000 will be used for extensions at the gas-works.

Electric Light Failure at Gloucester.—There was a sudden failure of the current from the Corporation electricity works at Gloucester during the morning of last Sunday week. The inconvenience was chiefly felt at churches having installations for lighting and for kinetic organ blowers. At the Cathedral the light in the choir went out. The cause of the failure was an iron bar falling on the strap of the dynamo and throwing it off for a few minutes.

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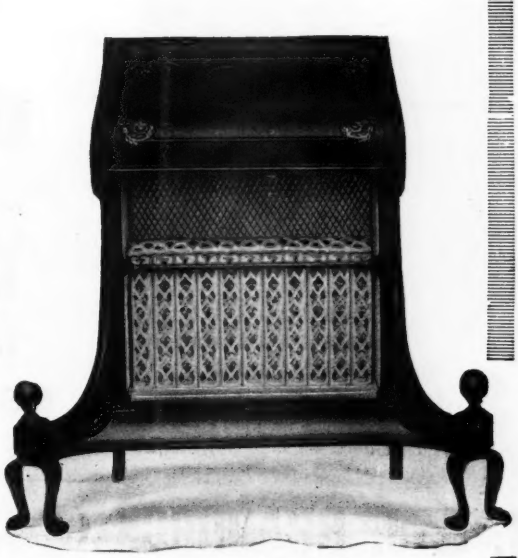

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NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The Glasgow Corporation Gas Department, who have been subscribers to the British Commercial Gas Association practically from the commencement, have decided to continue their membership on the basis of the standard rate of 2s. 6d. per million cubic feet of gas made. The Convener of the Gas Sub-Committee on Finance of the Corporation states that a good deal of the increased revenue from the use of gas cookers and fires has been brought about by the fact that the department advertise.

This week Messrs. Robert Dempster and Sons, Limited, have completed the erection of a Gadd and Mason steel spiral holder for the Catrine Gas Company, Limited, on ground just behind the works at a cost of about £1100. The tank is 16 ft. 4 in. deep and 46 ft. 6 in. diameter, and contains 173,300 gallons of water. The holder has a capacity of 25,000 cubic feet. The old holder, which has been in service for 78 years, is the last of the original plant; and during the past twelve years entirely new and up-to-date appliances have been installed.

An extension is to be made to the gas-works at Motherwell, and new plant introduced to economize labour and secure better results. A deputation from Motherwell have visited the Dundee Gas-Works, where they made a careful inspection of the new system of vertical retorts and also of the telpher plant. The visitors watched with much interest the rapid charging of the retorts and the handling of the coke. It is understood that an early commencement will be made with the new installation at Motherwell.

An alarming explosion of gas occurred in the Fife mining village of Low Valleyfield late on Wednesday evening, as a result of which the gable wall of a house was blown out, and much damage done to furniture. It appears that a pipe from the gas-main goes through the brick gable, which in places is hollow, and the fact that one side of the gable fell outwards and the other side inwards points to an escape having taken place in the pipe inside. Some of the gas may have found its way into the flues and become ignited. The occupants of the house escaped uninjured.

The Glasgow Gas Department Foremen's Association (which is apparently connected with the Municipal Employees' Association), open their first annual report with the following remarks: "After the first few preliminary meetings, the Association settled down to the serious business for which it was brought into being on Sept. 5, 1913; and while we have not won along the whole line, we have gained considerably in *morale*. We are not now striving individually and one against another. We are striving now as a united body to gain that which should have been ours by right as foremen of a great business concern—namely, the full confidence of the management with regard to our individual positions as foremen. No manager who wishes to be successful, or who had a dividend to make, would attempt to deal with his foremen through subordinates, and expect to be successful as a business man. We, as foremen, have not yet obtained that confidence from the management to which we are entitled; therefore, the business suffers. The higher-paid officials, through their constant contact with members of the Council, can very well look after their own interests financially. The wages of tradesmen and labourers, through their unions, have advanced rapidly during recent years. The wages of the foremen have not advanced in proportion to any of the above. During the past year, the Committee worked hard to secure better conditions." The report is signed G. J. Scott (President), R. Liggett (Secretary).

At a recent meeting of the Wick Town Council, several matters arising out of the war caused some discussion, especially the complete darkening of the streets, where all public lamps are now extinguished. Answering questions as to the responsibility for the darkness, Provost Harper said the order to extinguish all lights near the harbour came to him from the Scottish Office. Subsequently the local naval officer asked that streets should be darkened; and the Burgh Surveyor put out two out of every three lamps. This was not considered sufficient, and on one evening there were two requests that every lamp should be put out. Ex-Convener Nicolson questioned whether the officer had any right to insist on such complete darkness, and suggested that the Council should appeal direct to the Admiralty, as in present conditions it was simply impossible for people to go about at night.

At a special meeting of the Glasgow Corporation on the 8th inst. the Parliamentary Bills Committee submitted a minute in which they stated that no material alteration had been made in the Water Order as generally approved of by the Corporation on the 8th of October. It had been found necessary, however, as the result of preparing the parliamentary plans, to apply for power with respect to one or two additional works, including a new road in Glen Turk and an alteration of the level of the road where the aqueduct enters Loch Katrine. It was further proposed to increase the estimate from £312,000 to £327,000; and this alteration would be given effect to before the Order was deposited. A motion was submitted against the Corporation proceeding with the Order; but it received the support of only four members, and the recommendation of the Committee to go on with the scheme was adopted.

A special meeting of the District Committee of the Middle Ward of Lanarkshire was held a few days ago for the purpose of considering recommendations passed by a Sub-Committee that the Burghs Gas Supply (Scotland) Acts, 1876 and 1893 (as modified by the Lanarkshire Gas Order Confirmation Act, 1914), should be applied to the Cambuslang Special Lighting District and to areas adjacent. Mr. George Fraser, the Chairman, moved the adoption of the recommendations, which were passed.

At a meeting of the Paisley Town Council last Tuesday, the Water Committee submitted the conditions arranged between the Council and the Irvine and District Water Board for the supply of water by Paisley to the latter authority. With regard to the agreement, a letter

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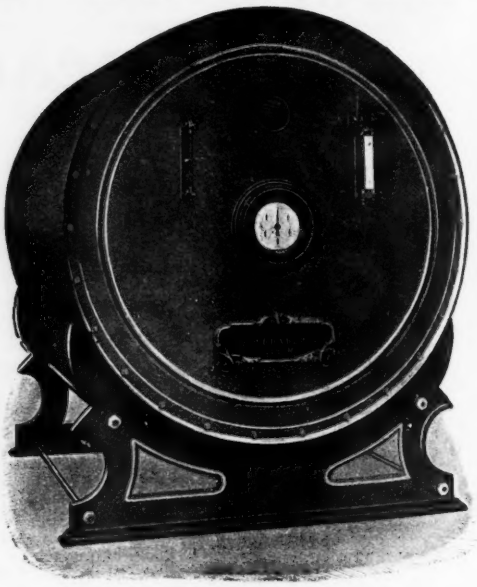

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was read from Mr. James Campbell, of Saltcoats, stating that the offer of supply had enabled his Board to arrange satisfactory terms with Messrs. Nobel's Explosives Company; and as the matter was urgent, a Special Provisional Order would be promoted, and its passage through Parliament, would be accelerated by the Government at the request of Messrs. Nobel.

Mr. James R. Milne, D.Sc., the Vice-President, occupied the chair last Monday night at the meeting of the Royal Scottish Society of Arts, when a paper was read by Dr. T. W. Drinkwater, F.I.C., on "Methods of Purifying Water." The various sources of town water supply and the relative merits of each source were discussed. Tracing the history of the water, from rain water to river, lake, and well, the lecturer described the characters of each kind of supply and their bearing on health. As regards river water, it was shown that the death-rate of towns supplied with river water compare favourably with those supplied by moorland and lake water. The problems connected with sand filtration were dealt with in some detail, and the various mechanical filters were explained. Chemical methods of treating polluted water so as to render it fit for primary purposes were described, and the results were illustrated by numerous analyses.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 21.

Export business in pitch continues exceedingly difficult, chiefly on account of the scarcity of freight and the abnormal rates prevailing. Owing to this, the price can only be called nominal. Values otherwise remain practically the same as reported last week. Solvent naphtha is, if anything, a little firmer.

The position of sulphate of ammonia is decidedly better, and the price for 25 per cent. quality for prompt delivery is £11 5s. per ton, net and naked, at makers' works, with a premium of 5s. per ton for the spring.

Tar Products in the Provinces.

Dec. 21.

Business in tar products has been very quiet during the past week. In pitch, there is little or no business doing. There has been a little more inquiry for benzol during the past week, and in some quarters the prices mentioned have been a trifle better. Toluol appears to be weaker, and there is more offering at the lower prices. Solvent naphtha has shown more signs of improvement, and transactions are reported at better prices. Creosote keeps firm, and the demand is fairly good. Crude carbolic is slightly weaker, and some quantities have been offered for January-June delivery at lower figures.

The average values during the week were: Value of liquid products in one ton of tar, 16s. 9d. to 18s. 3d. Benzol, 90 per cent., naked, North, 8½d. to 9d.; 50-90 per cent., naked, North, 1s. 2d. to 1s. 3d. Toluol, naked, North, 2s. 3d. to 2s. 4d. Crude naphtha, in bulk, North, 5¼d. to 5¾d. Solvent naphtha, naked, North, 9½d. to 10d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3⅜d. to 3 11/16d. Heavy oils, in bulk, 4d. to 4½d. Carbolic acid, casks included, 60 per cent., East and West coasts, 2s. 11d. to 3s. Naphthalene, £4 10s. to £10; salts, 60s. to 65s., bags included. Anthracene, "A" quality, 2d. per unit; "B," nominally ¾d.

Sulphate of Ammonia.

LIVERPOOL, *Dec.* 19.

Throughout the week there has been no diminution in the stren gth of the market, and all available supplies have been keenly competed for at still higher values. The demand has been largely from dealers, but there has also been a certain amount of direct buying. The closing quotations are £11 15s. per ton f.o.b. Hull, £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. The rapid advance in prompt prices has eliminated the premium for forward delivery, and transactions are reported at £11 15s. and £11 17s. 6d. per ton f.o.b. at the ports for January-June delivery.

Nitrate of Soda.

The market for this article is again dearer, and the spot quotations have been advanced to 10s. per cwt. for ordinary quality, and 10s. 6d. for refined.

Sulphate of Ammonia.

From another source it is reported that there has been considerable activity in this article during the past week, and prices have gone up somewhat, though the amount of actual business transacted has not been large. Outside London, makes to-day are quoted at £10 15s. to £10 17s. 6d.; Hull, £11 7s. 6d. to £11 10s.; Leith, £11 10s. to £11 12s. 6d.; Liverpool, £11 10s.; Middlesbrough, £11 10s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade has been more brisk; but the closing of ports wil interfere with it till new arrangements can be made. For the last few days there were heavy shipments of coal both to London and to some of the French and Italian ports, though the rates of freight were at record figures, when contracts did not intervene. In the steam coal trade, best Northumbrians are from 13s. to 13s. 2d. per ton f.o.b.; for second-class steams, the current quotation is about 10s. 9d. to 11s. 3d. per ton; and for steam smalls, the demand is steady at 7s. 3d. to 9s. per ton f.o.b., according to the quality. In the gas coal trade, there is a fair inquiry; but the consumption is less than usual at this season. Best Durhams are generally firm at 12s. 6d. per ton f.o.b. For good second-class gas coal, the inquiry is moderate, and the price about 11s. per ton; while for "Wear Specials," 13s. per ton is the f.o.b. quotation. The production of gas coal is good, when the diminished number

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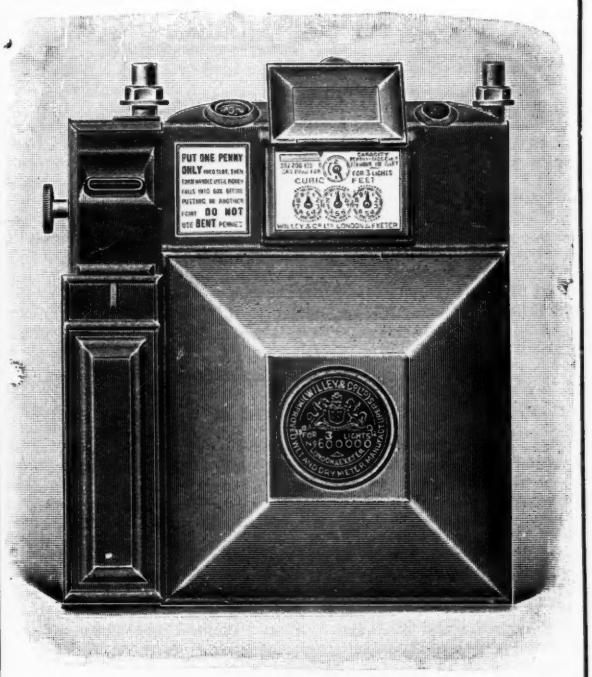

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of miners in the collieries is borne in mind. But the closing of part of the coast for a time will have its effect, for the holidays will soon restrict the output. There are inquiries in the market for next year, but the tendency seems to be to do business for short periods chiefly, though a week or two may settle the question of shipment and rate of freight in some degree. Coke is steady for furnace purposes. Gas coke is plentiful, and its price seems easier, at perhaps 10s. 10½d. to 11s. 6d. per ton f.o.b. in the Tyne.

The Suggested Suspension of Sinking Funds.

At the last meeting of the Ashton-under-Lyne Town Council, Mr. S. Kitchen asked if any information could be given regarding the deputation to the Local Government Board to meet representatives of other corporations to discuss the question of suspending the sinking fund payments. The Mayor (Mr. C. R. Wainwright) said that a deputation attended at the offices of the Board. The case was submitted by the Town Clerk of Blackburn (Mr. Lewis Beard), in a most explicit speech. Of course, they could never get a Cabinet Minister to promise anything—except what they might call sympathetic treatment. He was afraid he could not say anything further. They were received most cordially by Mr. Samuel, who said that, if any town could put a case before the authorities, it should have sympathetic treatment. The Mayor said he did not know what "sympathetic treatment" would mean; but they would have to wait and see. The tone of the meeting struck him that they might get something, but that they would have to make out a stronger case before they achieved their object.

Manchester and Tar Distillation.

Desirous of securing an answer to a question set by itself, the "Manchester Courier" has obtained the opinions of those well qualified to give them. The question was, "Can the Manchester Corporation follow the example of the Southport Corporation, and, by promoting a scheme for the distillation of the tar produced at the gas-works, help forward the aniline dye industry in this country?" The replies of officials in the Gas Department were to the effect that the present method of disposing of the tar in its crude state is the more profitable plan to the ratepayers. Mr. J. G. Newbigging (the Chief Engineer) said there was no analogy between Manchester and Southport. The question was one of *£ s. d.*; and so far the Corporation, who had at times had this matter under consideration, had not seen their way to adopt any scheme of the kind which would repay them for the outlay. Mr. F. A. Price (the Superintendent) stated that such a scheme would mean the setting-up of another very large and expensive department, which would have to include an expert staff of chemists. The project was too big. The matter was discussed during the chairmanship of the late Alderman Gibson; and he would have nothing to do with it. It had also been discussed by the Manchester Corporation on and off for the last fifty years; but it had never been found worth while to go in for the distillation of tar. The department at present disposed of the tar products in the crude state; and, all things considered, this was the more satisfactory method.

A Suggested State Board of Industry.

Speaking at Manchester a few days ago, Mr. Wilfrid Stokes, the Chairman of the Executive Committee of the British Engineers' Association, advocated the formation of a State Board of Industry for the defence and extension of British trade. He remarked that, while the greatness of England depended on her foreign trade, adequate machinery for properly extending and developing it was not provided by Government Departments. There should be bodies of trained men under qualified leaders all over the world to defend our trade. This force should possess an intimate knowledge of our business requirements; and its leaders should be well paid so as to attract men of marked capacity and ambition. A paid council, consisting of the best business men of the country and representatives of the High Commissioners of our self-governing dependencies, the India Office, and the Agents-General of the Colonies, should be formed, and should meet at intervals to decide upon the general policy to be followed. Some of the members should visit foreign countries and the Colonies to collect information at first hand; and the head should be a member of the Cabinet, and a permanent official chosen for his ability, and in receipt of a high salary. The Council should have a Parliamentary Secretary as their mouthpiece, appointed by the Government in office; and the department should be named the Board of Industry. Numerous qualified trade commissioners should be appointed in the dependencies and colonies, and in foreign countries, whose function would be the promotion of the foreign trade of the Empire, thus relieving Consuls of this part of their work. Our Ambassadors and Ministers should be provided with ample funds to further British trade by legitimate means; and the commercial *attaché* service should offer a separate and distinct career, and be made sufficiently attractive to always secure the right men.

Mallow Gas Undertaking.—Messrs. Stapleton and Co., in their auditors' report on the Mallow gas undertaking, stated that the total income for the half year to September last amounted to £868, and the expenditure to £659, leaving a balance of £209 as the net revenue from the undertaking for the period indicated. Expenditure on new mains and other items totalling £80 was exceptional, and would not recur for some time. The quantity of gas produced per ton of coal averaged 11,946 cubic feet, as against 9665 cubic feet for the corresponding period of last year; while the coke production averaged an increase of 1·35 per cent. per ton of coal carbonized. At a meeting of the Urban Council, the Chairman (Mr. E. Fitzgerald) said the report was very satisfactory, and expressed pleasure at the success of Mr. P. J. Philpott (the Gas Manager), who, he said, would, as long as he progressed on present lines, retain the confidence and esteem of members of the Council and the public.

ONE WAY

To Keep the Flag Flying is to Find Employment for those Left Behind.

WE ARE DOING OUR BEST.

Your esteemed orders for Prepayment or Ordinary Meters, Brasswork, or Repairs, will receive our Prompt Attention.

SAWER & PURVES

(BRANCH OF METERS LIMITED),

Miles Platting, Manchester. Radford Road, Nottingham.

Increase in the Price of Gas at Northampton.—The Directors of the Northampton Gas Company have announced an increase of 3d. per 1000 cubic feet in the price of gas consumed for lighting, and 1d. in that used for power purposes.

A New Holder for Walsall.—The plans and specifications for a new four-lift holder have been prepared by Mr. F. S. Cripps and submitted to the Walsall Gas Committee and the Town Council. Mr. Cripps states that if the Corporation desire the work carried out next year tenders should be invited at once, and the order placed if possible in January. Tenders are accordingly to be obtained for the new holder, and also for dismantling and removing the present one.

Blackburn Gas Engineership.—At a meeting of the Blackburn Gas Committee, the resignation of Mr. S. R. Ogden (announced in the last number of the "JOURNAL") was accepted. The Committee desired to recommend to the General Purposes Committee that he be paid six months' salary and £250 per annum for ten years in respect of such future services of a consultative character as might be required of him. The General Purposes Committee, however, passed a resolution that Mr. Ogden be paid three months' salary and £250 per annum for five years. This decision will come before the Town Council as a recommendation from the General Purposes Committee.

Gas-Fires at Cheltenham.—In a communication to the British Commercial Gas Association which appears in the "Bulletin" for the current month, Mr. James Paterson, M A , the Engineer and General Manager of the Cheltenham Gas Company, gives some interesting particulars in regard to the growth of the use of gas-fires in the town, in which there are no hiring or hire-purchase schemes in operation. Since 1909 10 a remarkable improvement has, he says, been experienced on what was already a satisfactory state of business. This is strikingly shown diagrammatically. Taking the yearly average sale of fires for the six years 1904-9 inclusive as 100, the yearly average for the four years 1910-13 inclusive is represented by 171—that is, a steady, and improving, increase of 71 per cent. in sales since 1910 over previous years. Mr. Paterson says this year is telling the same tale up to the present. He asks: "What is the cause?" He says it is certainly not cold winters. He thinks it is the growing popularity of the gas-fire, coupled with the tremendous influence wielded during the last three years by the Association and the cumulative effect of local advertising.

The Parkinson Stove Company, Limited, forward a copy of a booklet they have just issued, relating to the result of the tests made by the "Lancet" on their fires, as already noticed in the "JOURNAL" [*ante*, p. 354].

Mr. Harold C. Crohill, formerly Show-room Superintendent with the Cambridge University and Town Gaslight Company, has been appointed Sales Superintendent of the Aldershot Gas, Water, and District Lighting Company.

Messrs. A. & W. Richards (whose auction sales of gas and water stocks and shares are constantly referred to both in our news and advertisement pages) announce that, in consequence of the expiration of their lease at No. 18, Finsbury Circus, and the approaching demolition of the building, they have removed to No. 37, Walbrook, E.C.

"The Times" for Dec. 21, 1814 (the price was then 6½d., compared with 1d. to-day), contained a request by Mr. J. Pedder, the Secretary, that the proprietors of the Gas Light and Coke Company holding unconsolidated eighths of shares would transmit them to the offices at Peter Street, or Norton Folgate, with a communication of their desire "to dispose of the same, or to purchase others, for the purpose of consolidation."

Under the title of Brayshaw Furnaces and Tools, Limited, a Company has been registered with a capital of £30,000, in £1 shares (12 founders', 7188 six per cent. preference, and 22,800 to be issued as partly preference and partly ordinary), to take over the business carried on at Mulberry Street, Hulme, and Vernon Street, Longsight, Manchester, as S. N. Brayshaw, and to adopt an agreement between S. N Brayshaw and E. R. Brayshaw of the first part, John Wright and Eagle Range, Limited, of the second part, and W. C. Sheldon (for the Company) of the third part.

APPLICATIONS FOR LETTERS PATENT.

23,636.—KENT-JOHNSTON, A. G., "Controlling gas." Dec. 7.
23,680.—LINDEMANN, A. J., and A. J. LINDEMANN AND HOVERSON COMPANY, "Combined solid-fuel and gas stove." Dec. 7.
23,690.—HAUGHTON, G. B., and TUNGAY, S. J., "Packing for towers for washing gases, &c." Dec. 8.
23,734.—EWART, J. W., "Atmospheric burners." Dec. 8.
23,771.—ADAMS, M. J. "Gas-lighting." Dec. 9.
23,872.—SÖDERLUND, O., and TECHNO-CHEMICAL LABORATORIES, LTD., "Wet carbonization." Dec. 10.
23,925 —GOULD, F. J., "Globe-holders." A communication from G. Ross. Dec. 11.
23 963.—FLETCHER, RUSSELL, AND CO., LTD., and BANKS. W., "Auxiliary burners for gas-fires." Dec. 12.

GAS COMPANIES IN THE STOCK EXCHANGE.

The long protraction—howsoever unavoidable—of the negotiations and discussions relative to a re-opening of the Stock Exchange has at all events developed one fresh phase in the course of last week, when the growing impatience and dissatisfaction of members matured into a manifestation of something like revolt. The feeling of resentment was not prompted by the delay in the resumption of business in the House, but by the inaction of the Committee in regard to the provision of some temporary accommodation for members until such time as they can be readmitted to the Exchange. An Emergency Committee was formed, and they convened a meeting on Thursday, which was fairly well attended and which passed various resolutions, including one criticizing the composition of the Stock Exchange Committee as not being sufficiently representative in its character, and its methods as being antiquated and inefficient. The ventilation of grievances will do no harm if they are discussed by both sides with tact and temper. Business in the "trench," as the open street market has been dubbed, was fairly good during the week, and several markets exhibited improved strength. No prominent incident affecting gas values was noted. The Money Market was abundantly supplied.

Bank rate (fixed Aug 8), 5 per cent.; last year, 5 per cent.

OFFICIAL QUOTATIONS AT THE CLOSE OF THE STOCK EXCHANGE ON JULY 30.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59 64	..	3 18 2
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	..	5 1 3
380,000	5	April 29	7½	Bombay, Ltd.	5⅞—6⅜	..	5 17 8
50,000	10	Feb. 26	16	Bourne- 10 p.c.	29—30	..	5 6 8
878,480	10	,,	7	mouth Gas B 7 p.c.	15—15½	..	4 10 4
95,000	10	,,	6	and Water Pref. 6 p.c.	13½—14	..	4 5 9
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	..	5 5 3
380,000	,,	,,	11	Do. New	204—209	..	5 5 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	..	4 10 1
206,350	,,	June 11	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	..	5 3 4
244,200	,,	,,	8	Do. A Ord. Stk.	154—159	..	5 0 8
530,000	20	Mar. 26	12½	British	44—45	..	5 11 1
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	..	4 8 11
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	..	4 12 0
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	..	—
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	..	6 0 0
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	..	4 10 11
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	,,	June 11	8	Do. 3 p.c. Deb. Stk.	69½—71½	..	4 3 11
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	..	5 1 3
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	..	5 18 8
492,270	Stk.	—	6	Derby Con. Stk.	123—125	..	4 16 0
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11
1,092,180	10	July 29	10	European, Ltd.	17⅞—18*	..	5 11 1
16,362,910	Stk.	Feb. 12	4/17/4	Gas 4 p.c. Ord.	98—102	..	4 15 6
3,600,000	,,	,,	8½	Light 8½ p.c. max.	76—79	..	4 8 7
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	96—99	..	4 0 10
4,674,850	,,	June 11	8	Coke 8 p.c. Con. Deb.	72½—74½	..	4 0 6
358,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	..	5 12 4
70,000	10	April 29	17	Hongkong & China, Ltd.	16½—16¾	..	6 11 4
131,000	Stk.	Mar. 12	7½†	Ilford A and C	151—154	..	5 2 4
65,780	,,	,,	6⅝†	Do. B	115—118	..	5 8 0
66,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	..	5 12 6
1,265,000	Stk.	Feb. 12	8½	Do. 3½ p.c. Deb. Red.	84—86	..	4 1 5
200,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	..	5 7 6
661,000	Stk.	Feb. 26	10	Liverpool United A	211—213	..	4 13 11
718,100	,,	,,	7	Do. B	146—148	..	4 14 7
306,083	,,	June 26	4	Do. Deb. Stk.	97—99	..	4 0 10

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
75,000	5	June 11	0	Malta & Mediterranean	4⅛—4⅜	..	6 9 9
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	May 28	4	Monte Video, Ltd.	11½—12	..	6 13 4
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	..	4 10 6
529,705	Stk.	June 26	8½	Do. 3½ p.c. Deb.	82—88	..	4 4 10
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	..	5 2 8
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	..	6 11 2
60,000	5	Mar. 26	10	Ottoman, Ltd.	7⅛—7⅜	..	6 9 0
60,000	50	Feb. 26	18	Portsea, Island B	128—131	..	4 19 3
100,000	50	,,	12	Do. C	118—121	..	4 19 2
249,980	5	April 29	8	Primitiva Ord.	5⅛—6	..	6 18 4
499,960	5	June 26	5	,, 5 p.c. Pref.	4⅝—5	..	5 0 0
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	..	4 6 0
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	..	4 12 0
150,000	10	May 14	6	San Paulo 6 p.c. Pref.	10½—11	..	5 9 1
125,000	50	July 1	5	5 p.c. Deb.	47—49	..	5 2 0
185,000	Stk.	Mar. 12	10	Sheffield A	223—224	..	4 9 3
209,984	,,	,,	10	Do. B	222—224	..	4 9 3
523,500	,,	,,	10	Do. C	220—222	..	4 10 1
90,000	10	May 28	9	South African	10½—11½	..	7 16 6
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	..	4 16 8
1,895,445	,,	July 10	8	Do. 3 p.c. Deb.	72½—74½	..	4 0 6
209,830	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	..	5 6 11
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	..	5 3 5
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	..	4 9 3
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	..	4 4 9
629,740	Stk.	May 14	5	Southampton Ord.	99—102	..	4 18 0
120,000	Stk.	Feb. 12	7½†	Tottenham A 5 p.c.	135—138	..	5 8 8
742,275	,,	,,	6†	District B 3½ p.c.	115—117	..	5 2 7
181,255	,,	June 26	4	4 p.c. Deb.	87—89	..	4 9 11
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	..	5 5 3
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	..	4 11 4
				Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅝	Wandsworth A 5 p.c.	151—156	..	5 7 4
255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	..	5 2 7
108,075	,,	,,	5/17/8	,, C 3½ p.c.	110—115	..	5 2 0
352,000	,,	,,	6¼	Wimbledon 5 p.c.	117—122	..	5 0 5
98,000	,,	,,	6⅜	Epsom 5 p.c.	121—126	..	5 5 2
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	..	4 6 11

Prices marked * are "Ex Div." † Next Dividend will be at this rate.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, Vacant.

GAS MANAGER. Wantage Urban District Council. Applications by Dec. 28.
JUNIOR DRAUGHTSMAN. Derby Gas Light Company.
RETORT-HOUSE FOREMAN. No. 5969.
MANTLE MANUFACTURER. "Mantles," c/o William Porteous and Co., Glasgow.
WATER-WORKS FOREMAN. Winchester Water and Gas Company.

Appointment Wanted.

CHEMICAL ENGINEER (Dutch). No. 5970.

Plant, &c. (Second Hand), Wanted.

PLUNGER PUMP. "Artesian," c/o Deacon's, Leadenhall Street, E.C.

Plant, &c. (Second-Hand), for Sale.

CONDENSERS, WASHERS, AND SCRUBBERS. Croydon Gas Company.

Gas-Works Wanted.

Particulars to "PRINCIPAL," Scripps's Advertising Offices, 13, South Molton Street.

Sales of Stocks and Shares.

BOURNEMOUTH GAS AND WATER COMPANY. London Mart. Jan. 19.
SHREWSBURY GAS LIGHT COMPANY (Mortgage Bonds).
TOTTENHAM DISTRICT LIGHT, HEAT, AND POWER COMPANY. By Tender. Jan. 19.

TENDERS FOR

Hydrants, Valves, Cast-Iron Work, Lead, &c.

PLYMOUTH WATER DEPARTMENT. Tenders by Dec. 28.

Tar (Distilled).

BRENTFORD URBAN DISTRICT COUNCIL. Tenders by Jan. 2.

Tar and Liquor.

HARWICH GAS COMPANY. Tenders by Jan. 4.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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See Illustrated Advertisement, Dec. 15, p. 634.

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